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PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No. PCT/DK 00/00050

04 FEBRUARY 2000
International Filing Date Danish Patent and Trademark Office

PCT-International Application

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference (if desired) (12 characters maximum) P199900136 WO

Box No. I TITLE OF INVENTION

A programmable toy with communication means

Box No. II APPLICANT

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

LEGO A/S
Aastvej 1
DK-7190 Billund
DENMARK

☐ This person is also inventor.

Telephone No.

Facsimile No.

Teleprinter No.

State (that is, country) of nationality:
DK Denmark

State (that is, country) of residence:
DK Denmark

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☒ the States indicated in the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

INTERLEGO AG
Neuhofstrasse 21
CH-6340 Baar
SWITZERLAND

This person is:

☒ applicant only

☐ applicant and inventor

☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:
CH Switzerland

State (that is, country) of residence:
CH Switzerland

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☒ the States indicated in the Supplemental Box

☒ Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:

☒ agent

☐ common representative

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

Hofman-Bang A/S
Hans Bekkevolds Allé 7
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DENMARK

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19 085 hbbdk

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

CONFIRMATION COPY

Continuation of Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)	
<i>If none of the following sub-boxes is used, this sheet should not be included in the request.</i>	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.) MUNCH, Gaute Granslevbyvej 19 DK-8870 Langå DENMARK	This person is: <input type="checkbox"/> applicant only <input checked="" type="checkbox"/> applicant and inventor <input type="checkbox"/> inventor only (If this check-box is marked, do not fill in below.)
State (that is, country) of nationality: DK Denmark	State (that is, country) of residence: DK Denmark
This person is applicant for the purposes of: <input type="checkbox"/> all designated States <input type="checkbox"/> all designated States except the United States of America <input checked="" type="checkbox"/> the United States of America only <input type="checkbox"/> the States indicated in the Supplemental Box	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.) RASMUSSEN, Jesper Thit Jensen Vej 37 DK-7182 Bredsted DENMARK	This person is: <input type="checkbox"/> applicant only <input checked="" type="checkbox"/> applicant and inventor <input type="checkbox"/> inventor only (If this check-box is marked, do not fill in below.)
State (that is, country) of nationality: DK Denmark	State (that is, country) of residence: DK Denmark
This person is applicant for the purposes of: <input type="checkbox"/> all designated States <input type="checkbox"/> all designated States except the United States of America <input checked="" type="checkbox"/> the United States of America only <input type="checkbox"/> the States indicated in the Supplemental Box	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.) 	This person is: <input type="checkbox"/> applicant only <input type="checkbox"/> applicant and inventor <input type="checkbox"/> inventor only (If this check-box is marked, do not fill in below.)
State (that is, country) of nationality:	State (that is, country) of residence:
This person is applicant for the purposes of: <input type="checkbox"/> all designated States <input type="checkbox"/> all designated States except the United States of America <input type="checkbox"/> the United States of America only <input type="checkbox"/> the States indicated in the Supplemental Box	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.) 	This person is: <input type="checkbox"/> applicant only <input type="checkbox"/> applicant and inventor <input type="checkbox"/> inventor only (If this check-box is marked, do not fill in below.)
State (that is, country) of nationality:	State (that is, country) of residence:
This person is applicant for the purposes of: <input type="checkbox"/> all designated States <input type="checkbox"/> all designated States except the United States of America <input type="checkbox"/> the United States of America only <input type="checkbox"/> the States indicated in the Supplemental Box	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.) 	This person is: <input type="checkbox"/> applicant only <input type="checkbox"/> applicant and inventor <input type="checkbox"/> inventor only (If this check-box is marked, do not fill in below.)
State (that is, country) of nationality:	State (that is, country) of residence:
This person is applicant for the purposes of: <input type="checkbox"/> all designated States <input type="checkbox"/> all designated States except the United States of America <input type="checkbox"/> the United States of America only <input type="checkbox"/> the States indicated in the Supplemental Box	
<input type="checkbox"/> Further applicants and/or (further) inventors are indicated on another continuation sheet.	

Box No.V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) (mark the applicable check-boxes; at least one must be marked):

Regional Patent

- ☒ AP ARIPO Patent: GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, SD Sudan, SL Sierra Leone, SZ Swaziland, TZ United Republic of Tanzania, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- ☒ EA Eurasian Patent: AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- ☒ EP European Patent: AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☒ OA OAPI Patent: BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT (if other kind of protection or treatment desired, specify on dotted line)

National Patent (if other kind of protection or treatment desired, specify on dotted line):

- | | |
|--|--|
| <input checked="" type="checkbox"/> AE United Arab Emirates | <input checked="" type="checkbox"/> LR Liberia |
| <input checked="" type="checkbox"/> AL Albania | <input checked="" type="checkbox"/> LS Lesotho |
| <input checked="" type="checkbox"/> AM Armenia | <input checked="" type="checkbox"/> LT Lithuania |
| <input checked="" type="checkbox"/> AT Austria and Utility Model | <input checked="" type="checkbox"/> LU Luxembourg |
| <input checked="" type="checkbox"/> AU Australia | <input checked="" type="checkbox"/> LV Latvia |
| <input checked="" type="checkbox"/> AZ Azerbaijan | <input checked="" type="checkbox"/> MA Morocco |
| <input checked="" type="checkbox"/> BA Bosnia and Herzegovina | <input checked="" type="checkbox"/> MD Republic of Moldova |
| <input checked="" type="checkbox"/> BB Barbados | <input checked="" type="checkbox"/> MG Madagascar |
| <input checked="" type="checkbox"/> BG Bulgaria | <input checked="" type="checkbox"/> MK The former Yugoslav Republic of Macedonia |
| <input checked="" type="checkbox"/> BR Brazil | |
| <input checked="" type="checkbox"/> BY Belarus | <input checked="" type="checkbox"/> MN Mongolia |
| <input checked="" type="checkbox"/> CA Canada | <input checked="" type="checkbox"/> MW Malawi |
| <input checked="" type="checkbox"/> CH and LI Switzerland and Liechtenstein | <input checked="" type="checkbox"/> MX Mexico |
| <input checked="" type="checkbox"/> CN China | <input checked="" type="checkbox"/> NO Norway |
| <input checked="" type="checkbox"/> CR Costa Rica | <input checked="" type="checkbox"/> NZ New Zealand |
| <input checked="" type="checkbox"/> CU Cuba | <input checked="" type="checkbox"/> PL Poland |
| <input checked="" type="checkbox"/> CZ Czech Republic and Utility Model | <input checked="" type="checkbox"/> PT Portugal |
| <input checked="" type="checkbox"/> DE Germany and Utility Model | <input checked="" type="checkbox"/> RO Romania |
| <input checked="" type="checkbox"/> DK Denmark and Utility Model | <input checked="" type="checkbox"/> RU Russian Federation |
| <input checked="" type="checkbox"/> DM Dominica | <input checked="" type="checkbox"/> SD Sudan |
| <input checked="" type="checkbox"/> EE Estonia and Utility Model | <input checked="" type="checkbox"/> SE Sweden |
| <input checked="" type="checkbox"/> ES Spain | <input checked="" type="checkbox"/> SG Singapore |
| <input checked="" type="checkbox"/> FI Finland and Utility Model | <input checked="" type="checkbox"/> SI Slovenia |
| <input checked="" type="checkbox"/> GB United Kingdom | <input checked="" type="checkbox"/> SK Slovakia and Utility Model |
| <input checked="" type="checkbox"/> GD Grenada | <input checked="" type="checkbox"/> SL Sierra Leone |
| <input checked="" type="checkbox"/> GE Georgia | <input checked="" type="checkbox"/> TJ Tajikistan |
| <input checked="" type="checkbox"/> GH Ghana | <input checked="" type="checkbox"/> TM Turkmenistan |
| <input checked="" type="checkbox"/> GM Gambia | <input checked="" type="checkbox"/> TR Turkey |
| <input checked="" type="checkbox"/> HR Croatia | <input checked="" type="checkbox"/> TT Trinidad and Tobago |
| <input checked="" type="checkbox"/> HU Hungary | <input checked="" type="checkbox"/> TZ United Republic of Tanzania |
| <input checked="" type="checkbox"/> ID Indonesia | <input checked="" type="checkbox"/> UA Ukraine |
| <input checked="" type="checkbox"/> IL Israel | <input checked="" type="checkbox"/> UG Uganda |
| <input checked="" type="checkbox"/> IN India | <input checked="" type="checkbox"/> US United States of America |
| <input checked="" type="checkbox"/> IS Iceland | |
| <input checked="" type="checkbox"/> JP Japan | <input checked="" type="checkbox"/> UZ Uzbekistan |
| <input checked="" type="checkbox"/> KE Kenya | <input checked="" type="checkbox"/> VN Viet Nam |
| <input checked="" type="checkbox"/> KG Kyrgyzstan | <input checked="" type="checkbox"/> YU Yugoslavia |
| <input checked="" type="checkbox"/> KP Democratic People's Republic of Korea | <input checked="" type="checkbox"/> ZA South Africa |
| | <input checked="" type="checkbox"/> ZW Zimbabwe |

Check-boxes reserved for designating States which have become party to the PCT after issuance of this sheet:

- ☐
- ☐

Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. (Confirmation (including fees) must reach the receiving Office within the 15-month time limit.)

Supplemental Box*If the Supplemental Box is not used, this sheet should not be included in the request.*

1. If, in any of the Boxes, the space is insufficient to furnish all the information: in such case, write "Continuation of Box No. ..." [indicate the number of the Box] and furnish the information in the same manner as required according to the captions of the Box in which the space was insufficient, in particular:

- (i) if more than two persons are involved as applicants and/or inventors and no "continuation sheet" is available: in such case, write "Continuation of Box No. III" and indicate for each additional person the same type of information as required in Box No. III. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below;
- (ii) if, in Box No. II or in any of the sub-boxes of Box No. III, the indication "the States indicated in the Supplemental Box" is checked: in such case, write "Continuation of Box No. II" or "Continuation of Box No. III" or "Continuation of Boxes No. II and No. III" (as the case may be), indicate the name of the applicant(s) involved and, next to (each) such name, the State(s) (and/or, where applicable, ARIPO, Eurasian, European or OAPI patent) for the purposes of which the named person is applicant;
- (iii) if, in Box No. II or in any of the sub-boxes of Box No. III, the inventor or the inventor/applicant is not inventor for the purposes of all designated States or for the purposes of the United States of America: in such case, write "Continuation of Box No. II" or "Continuation of Box No. III" or "Continuation of Boxes No. II and No. III" (as the case may be), indicate the name of the inventor(s) and, next to (each) such name, the State(s) (and/or, where applicable, ARIPO, Eurasian, European or OAPI patent) for the purposes of which the named person is inventor;
- (iv) if, in addition to the agent(s) indicated in Box No. IV, there are further agents: in such case, write "Continuation of Box No. IV" and indicate for each further agent the same type of information as required in Box No. IV;
- (v) if, in Box No. V, the name of any State (or OAPI) is accompanied by the indication "patent of addition," or "certificate of addition," or if, in Box No. V, the name of the United States of America is accompanied by an indication "continuation" or "continuation-in-part": in such case, write "Continuation of Box No. V" and the name of each State involved (or OAPI), and after the name of each such State (or OAPI), the number of the parent title or parent application and the date of grant of the parent title or filing of the parent application;
- (vi) if, in Box No. VI, there are more than three earlier applications whose priority is claimed: in such case, write "Continuation of Box No. VI" and indicate for each additional earlier application the same type of information as required in Box No. VI;
- (vii) if, in Box No. VI, the earlier application is an ARIPO application: in such case, write "Continuation of Box No. VI", specify the number of the item corresponding to that earlier application and indicate at least one country party to the Paris Convention for the Protection of Industrial Property or one Member of the World Trade Organization for which that earlier application was filed.

2. If, with regard to the precautionary designation statement contained in Box No. V, the applicant wishes to exclude any State(s) from the scope of that statement: in such case, write "Designation(s) excluded from precautionary designation statement" and indicate the name or two-letter code of each State so excluded.

3. If the applicant claims, in respect of any designated Office, the benefits of provisions of the national law concerning non-prejudicial disclosures or exceptions to lack of novelty: in such case, write "Statement concerning non-prejudicial disclosures or exceptions to lack of novelty" and furnish that statement below.

Continuation of Box II:

LEGO A/S: All designated states except:
AU, BR, CA, CN, GB, IE, IN, MX, NZ, SG & US

Continuation of Box III:

INTERLEGO AG: AU, BR, CA, CN, GB, IE, IN, MX, NZ & SG

Box No. VI PRIORITY CLAIM		<input type="checkbox"/> Further priority claim indicated in the International B		
Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is:		
		national application: country	regional application: regional Office	international application: receiving Office
item (1) 04.02.1999	PA 199900144	Denmark		
item (2)				
item (3)				

☐ The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) (only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office) identified above as item(s):

* Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.

Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA)
(if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):

Request to use results of earlier search; reference to that search (if an earlier search has been carried out by or requested from the International Searching Authority):

Date (day/month/year)	Number	Country (or regional Office)
05.02.1999	DK 99/00027	Denmark

Box No. VIII CHECK LIST; LANGUAGE OF FILING

This international application contains the following number of sheets:

request : 5
description (excluding sequence listing part) : 19
claims : 3
abstract : 1
drawings : 8
sequence listing part of description :
Total number of sheets : 36

This international application is accompanied by the item(s) marked below:

- ☒ fee calculation sheet
- ☐ separate signed power of attorney
- ☐ copy of general power of attorney; reference number, if any:
- ☐ statement explaining lack of signature
- ☐ priority document(s) identified in Box No. VI as item(s):
- ☐ translation of international application into (language):
- ☐ separate indications concerning deposited microorganism or other biological material
- ☐ nucleotide and/or amino acid sequence listing in computer readable form
- ☒ other (specify): DK 99/00027

Figure of the drawings which should accompany the abstract:

5

Language of filing of the international application:

Danish

Box No. IX SIGNATURE OF APPLICANT OR AGENT

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

REGO A/S
Bryan Sørensen
General Counsel

INTERLEAF AG
Sven Sanvid Bach
General Manager

Gaute Munch

Helle S. Kaspersen
Corporate Counsel

Peter Bolli
Vice-President

Jesper Rasmussen
Jesper Rasmussen

For receiving Office use only

1. Date of actual receipt of the purported international application: RO/DK 4 FEBRUARY 2000 (04.02.00)	2. Drawings: <input type="checkbox"/> received: <input type="checkbox"/> not received:
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:	
4. Date of timely receipt of the required corrections under PCT Article 11(2):	
5. International Searching Authority (if two or more are competent): ISA/ SE	
6. <input type="checkbox"/> Transmittal of search copy delayed until search fee is paid.	

For International Bureau use only

Date of receipt of the record copy by the International Bureau:

23 FEBRUARY 2000 (23.02.00)

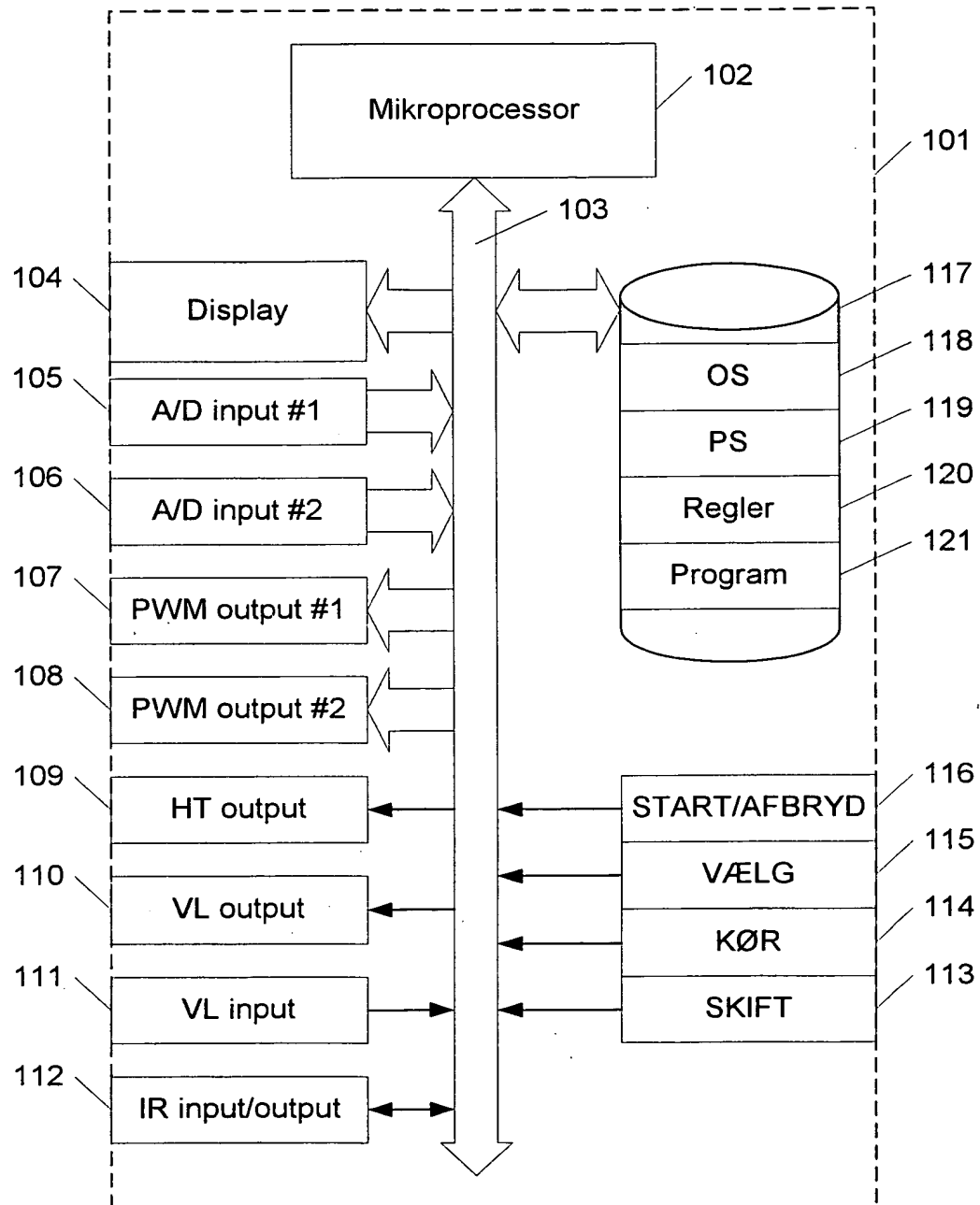


Fig. 1

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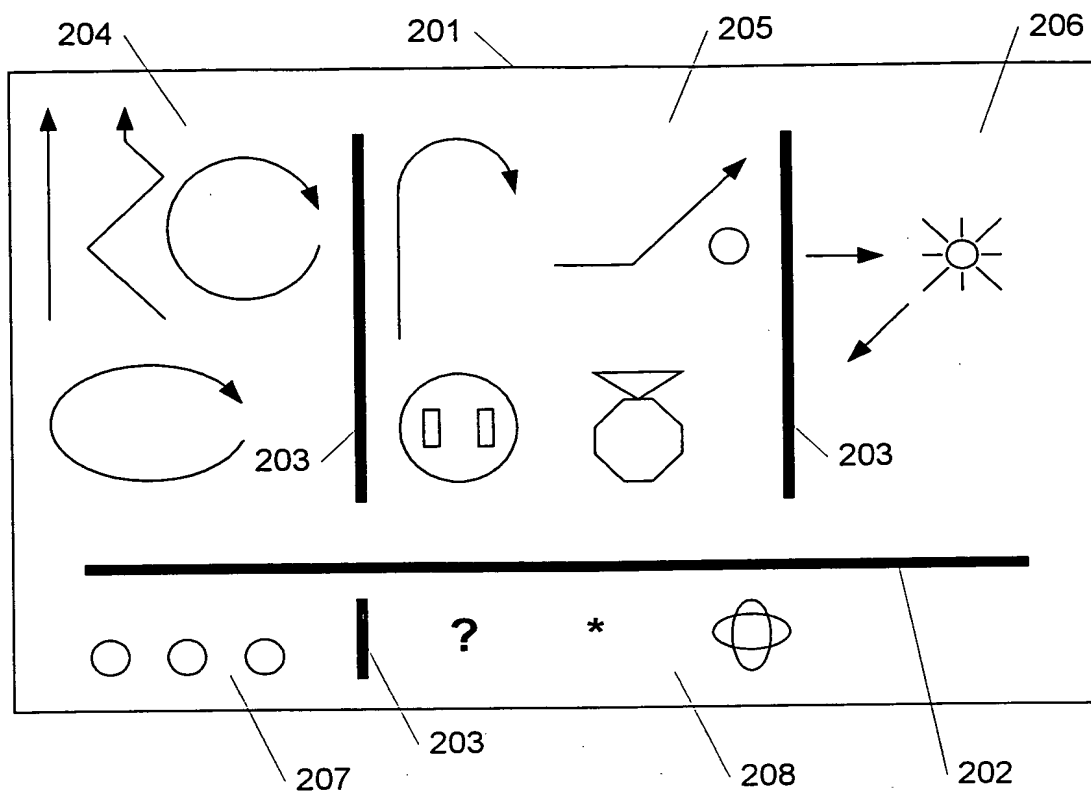


Fig. 2

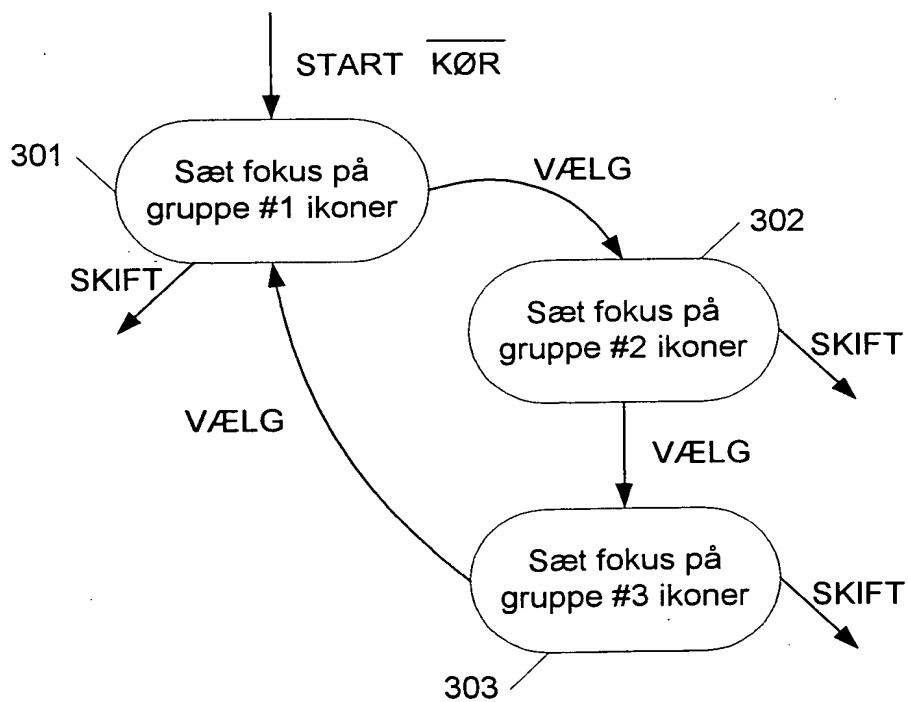


Fig. 3a

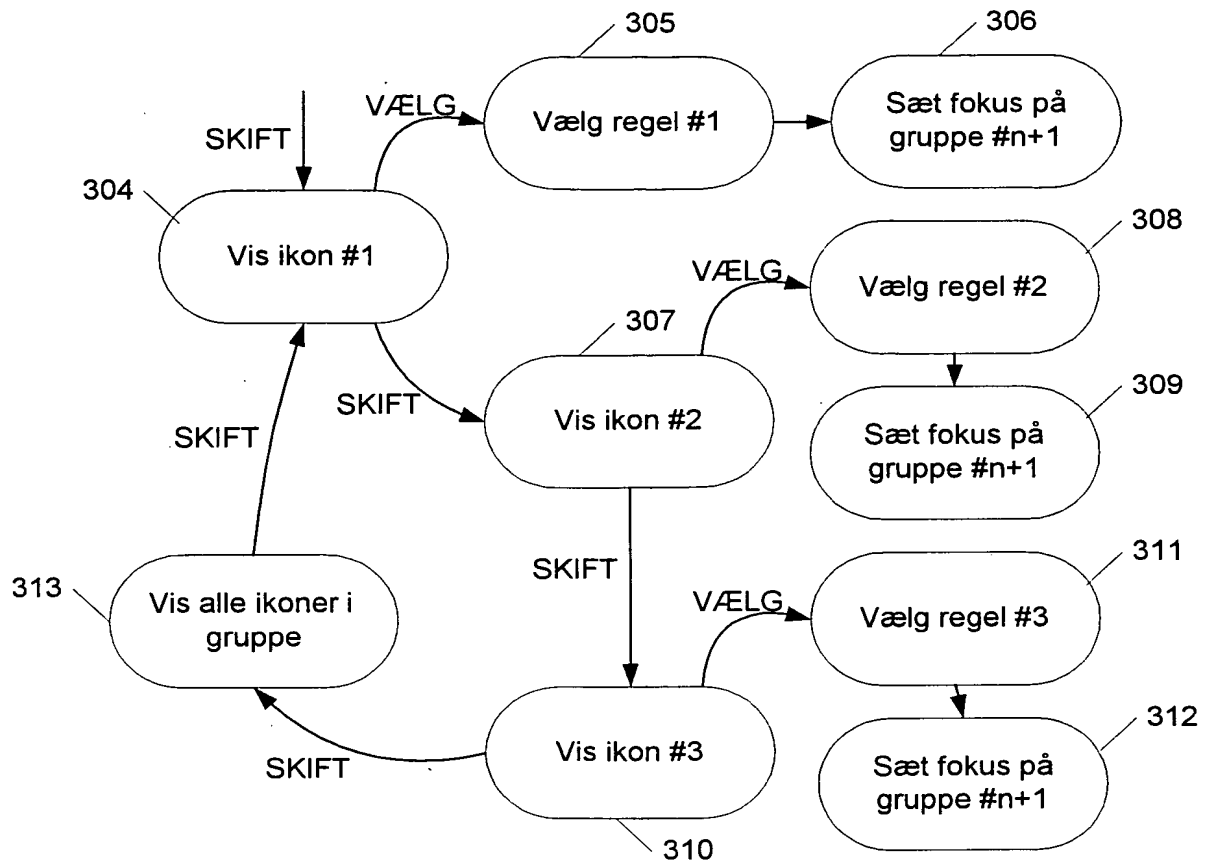


Fig. 3b

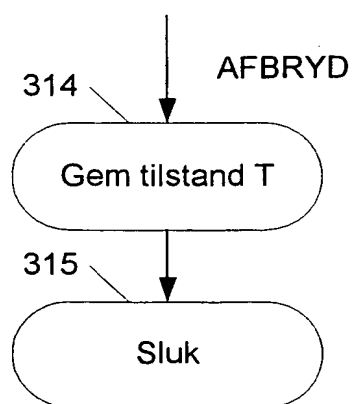


Fig. 3c

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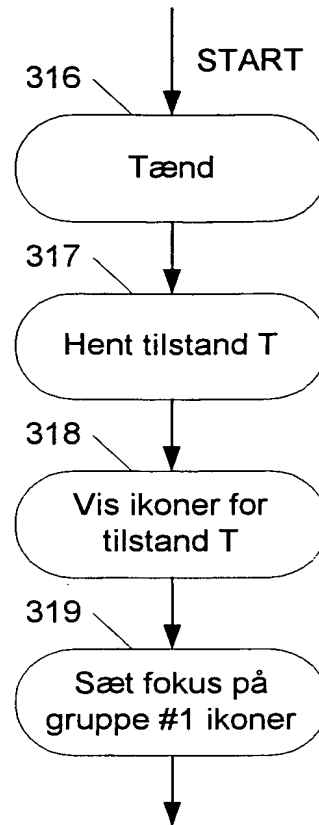


Fig. 3d

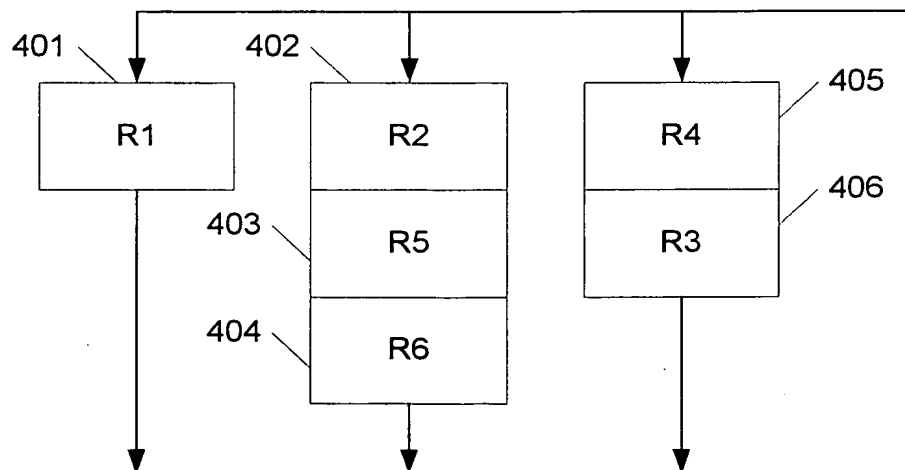


Fig. 4

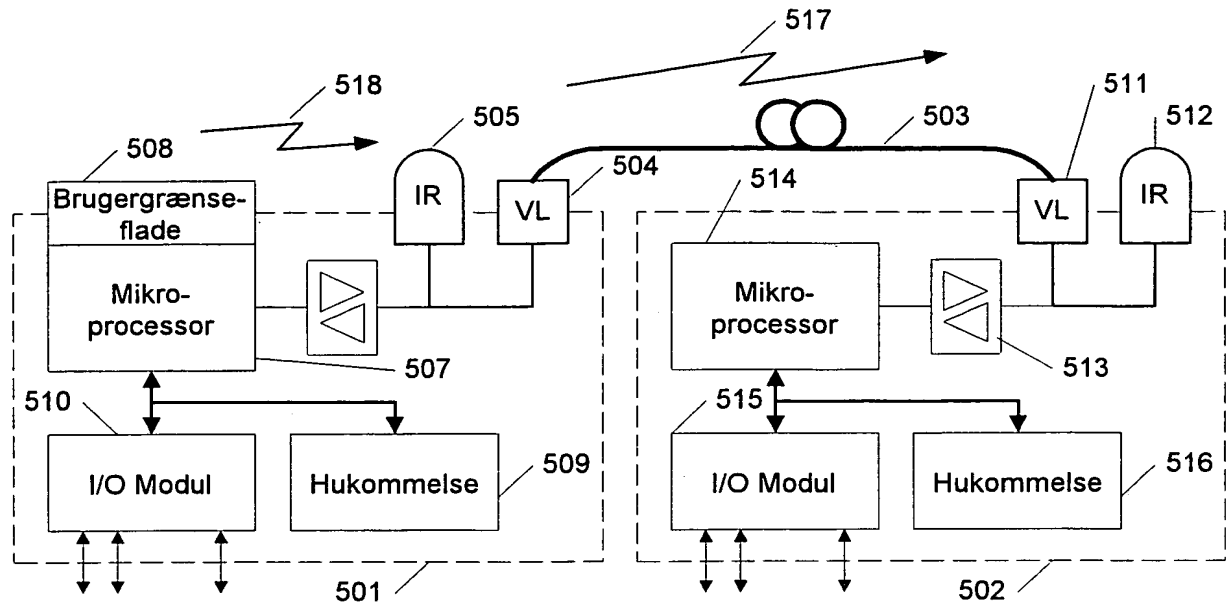
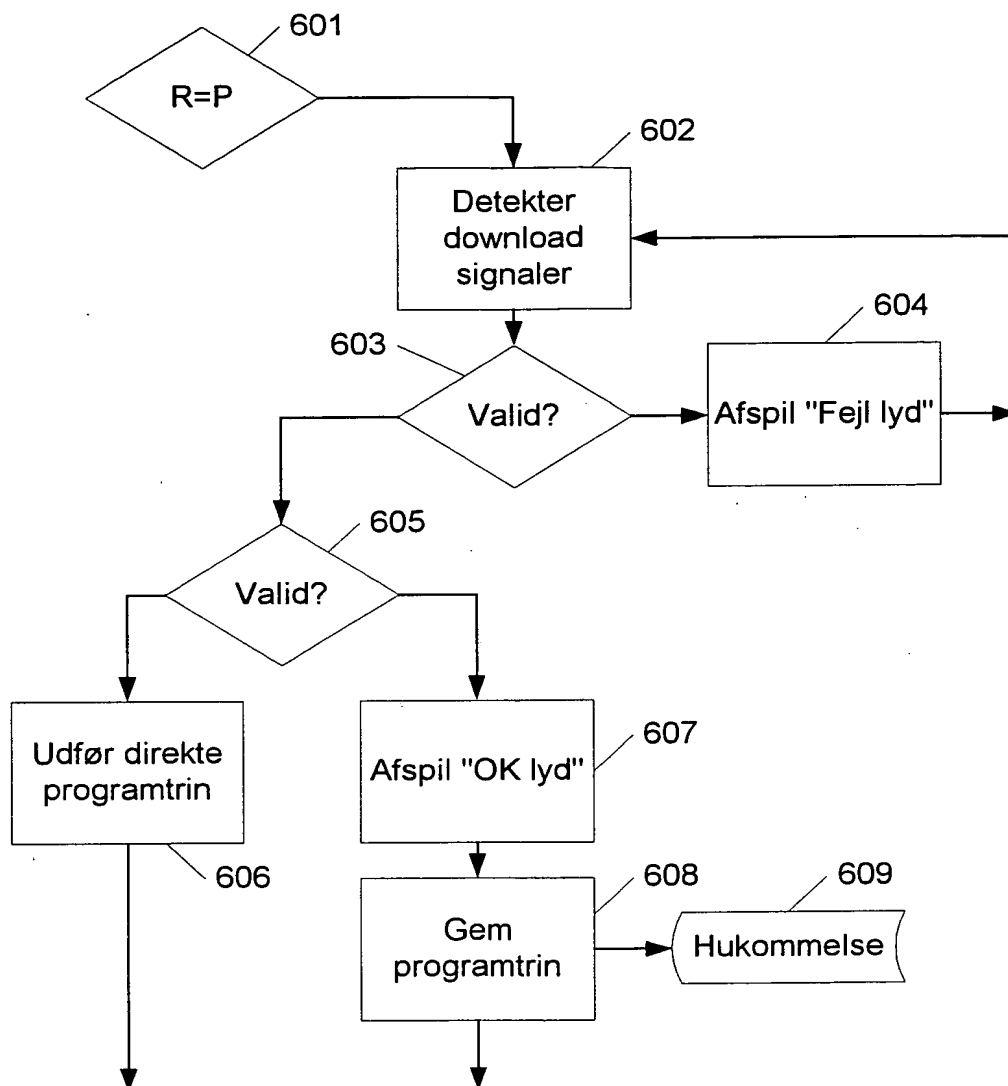


Fig. 5

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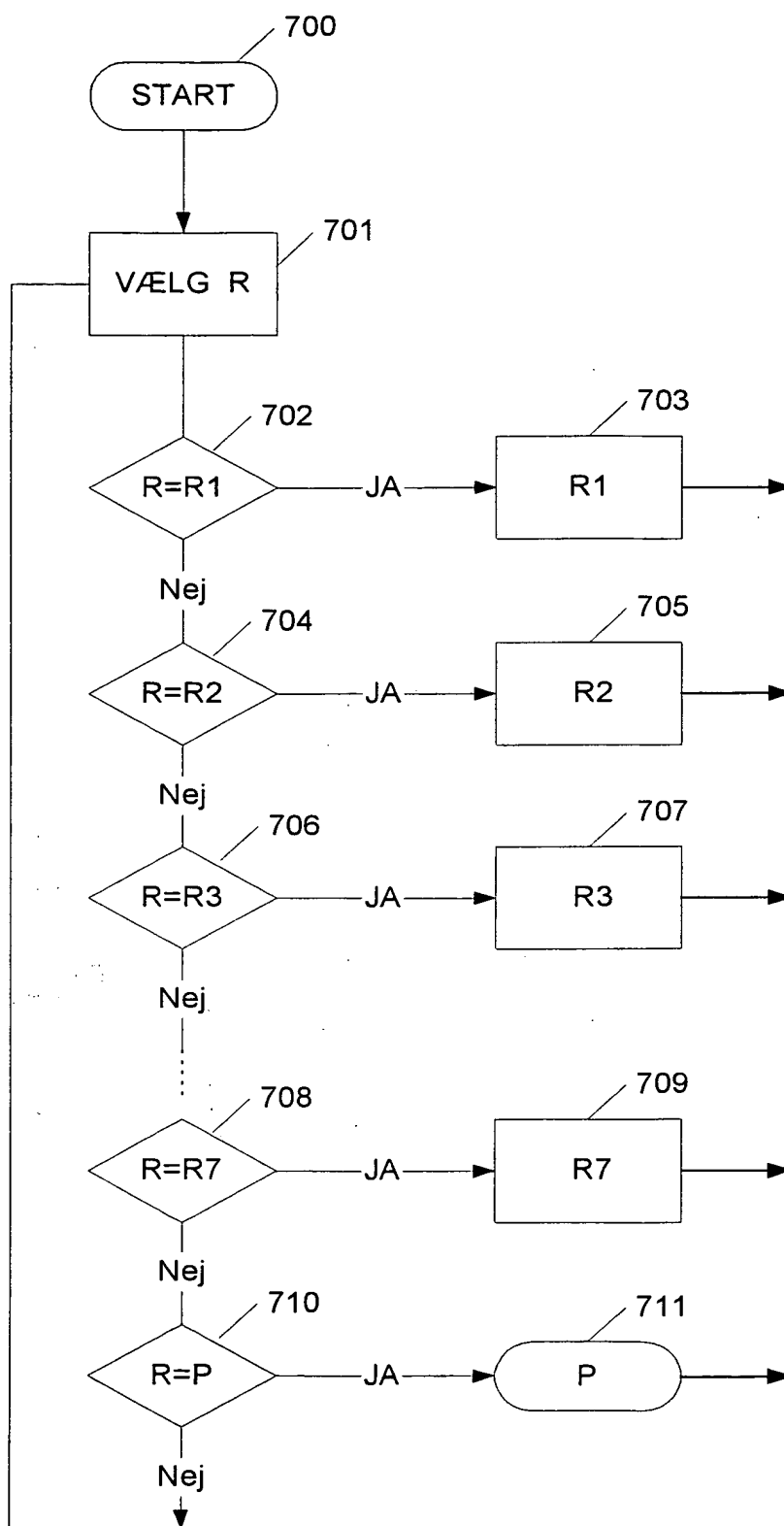


Fig. 7

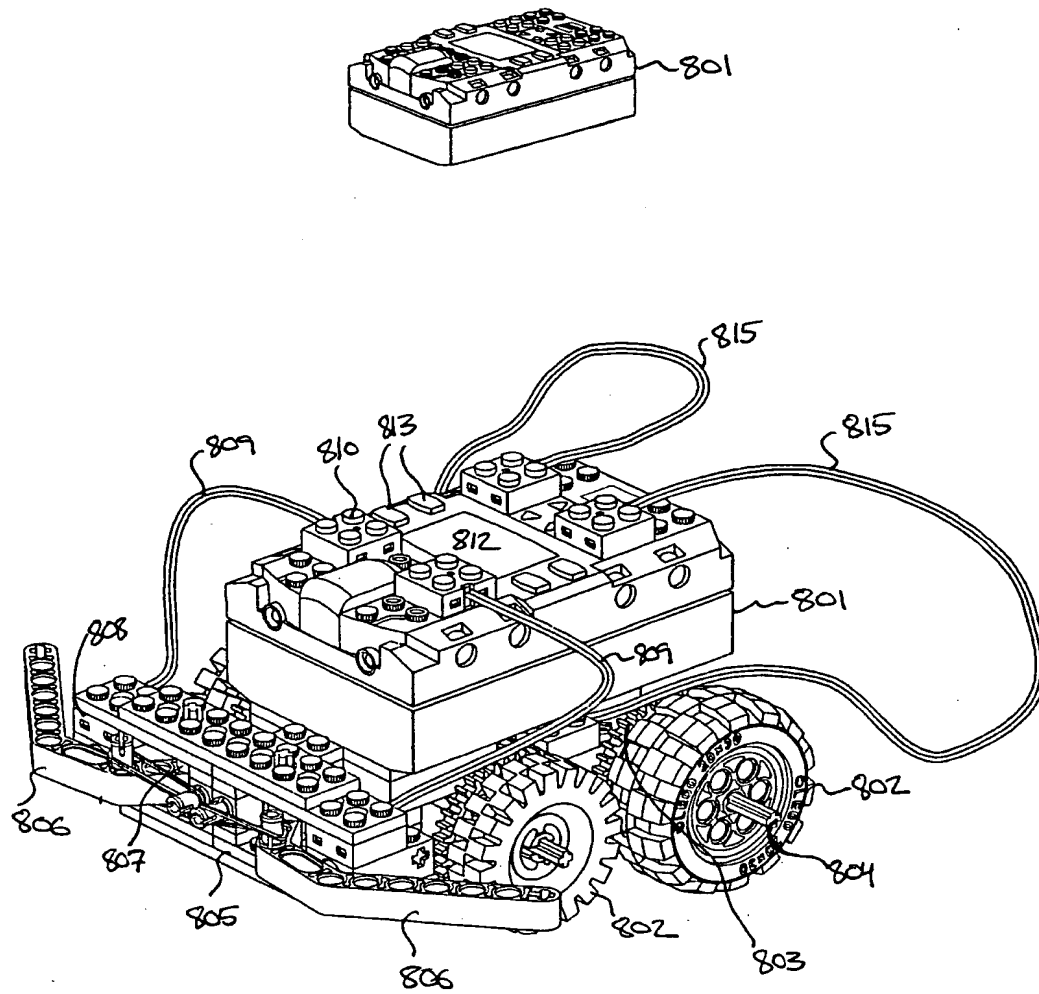


Fig. 8

Programmerbart legetøj med kommunikationsmidler.

Opfindelsen angår et mikroprocessorstyret legetøjsbygge-
element omfattende en mikroprocessor, der kan udføre in-
5 struktioner i form af et program lagret i en hukommelse,
hvor hukommelsen omfatter delprogrammer, som kan aktive-
res individuelt ved at specificere en liste af delpro-
gramkald; koblingsmidler for sammenkobling med byggeele-
10 menter, der kan bevæges ved hjælp af aktiveringsorganer,
hvor aktiveringsorganerne kan styres i afhængighed af in-
struktionerne.

I forbindelse med udviklingen af små, avancerede og rela-
tivt billige mikroprocessorer, er det blevet attraktivt
at benytte disse i mange forskellige konsumentprodukter -
15 herunder legetøj. Generelt set er udviklingen af legetøj
gået fra simple funktioner som afspilning af lyde i duk-
ker, udførelse af simple bevægemønstre i robotter osv.
mod udvikling af legetøj med avancerede handlingsmønstre
og en form for adfærd.

20 Sådanne legetøjsbyggeelementer kan udføre forskellige fy-
siske handlinger ved dels at programmere legetøjsbygge-
elementet og dels ved at bygge en konstruktion, der be-
står af sammenkoblede legetøjsbyggeelementer af forskel-
lig type. Der er dermed talrige kombinationsmuligheder
25 for at lave konstruktioner og give konstruktionerne for-
skellige funktioner. De fysiske handlinger kan være ube-
tingede og omfatte simple eller komplekse bevægelser sty-
ret af en elektrisk motor samt udsendelse af lys- og lyd-
signaler. De fysiske handlinger kan også være betingede
30 af legetøjets interaktion med dets omgivelser, og legetøj-
et kan da programmeres til at reagere på fysisk kontakt
med et objekt eller på lys og eventuelt lyd og ændre sin
adfærd på basis af sådan interaktion.

CONFIRMATION COPY

Sådan programmerbart legetøj kendes eksempelvis fra produktet ROBOTICS INVENTION SYSTEM fra LEGO MINDSTORMS, som er et legetøj, som ved hjælp af en computer kan programmeres til at foretage såvel ubetingede som betingede
5 handlinger.

CA 2,225,060 angår interaktive legetøjsselementer; et første legetøjsselementet aktiveret af en bruger kan aktivere et andet legetøjsselement, der igen kan aktivere det første legetøjsselement eller et tredje legetøjsselement. Legetøjsselementerne kan være i form af dukker, dyr eller en
10 bil der kan udføre aktiviteter.

Det er imidlertid et problem med dette legetøj at legetøjet kræver en ekstern computer for at kunne overføre brugerdefinerede programmer til et sådant mikroprocessorstyret legetøjsselement. Det har netop været en fordom inden
15 for den kendte teknik, at udveksling af programmer mellem legetøjsselementer kun er relevant mellem identiske legetøjsselementer, da der ellers vil være muligheder for fejl i interaktionen mellem et program og en mekanisk konstruktion.
20

Inden for området konstruktionslegetøj er det en typisk situation, at konstruktioner bygges og modificeres ustandseligt. Da dette er en del af legen, er der dermed brug for hurtigt at kunne aktivere et nyt program tilpasset den specifikke konstruktion.
25

Der er derfor en formål med opfindelsen at angive et mikroprocessorstyrede legetøjsbyggeelement, har mere fleksible programmeringsfunktioner.

Dette opnås når det indledningsvis nævnte mikroprocessorstyrede legetøjsbyggeelement er kendetegnet ved at omfatte kommunikationsmidler, der kan transmittere nævnte
30

funktionskald til et andet legetøjsbyggeelement for programmering af dette.

Dermed kan et første mikroprocessorstyret legetøjsbyggeelement sende en liste af funktionskald til et andet mikroprocessorstyret legetøjsbyggeelement. Når det andet legetøjsbyggeelement har lagret delprogrammer kendt af det første legetøjsbyggeelement, kan der hurtigt udveksles programmer mellem to legetøjsbyggeelementer. Dermed kan potentialet i konstruktionslegetøj, der er baseret på funktionaliteten mellem et antal standardbyggeelementer i en konstruktion og et antal standard programtrin udnyttes på en effektiv måde.

I det følgende vil en foretrukken udførelsesform for opfindelsen blive beskrevet under henvisning til tegningen, hvor

fig. 1 viser et blokdiagram for et programmerbart legetøjselement;

fig. 2 viser et display på et legetøjselement;

fig. 3a viser et første diagram for en tilstandsmaskine for visuel programmering af et legetøjselement;

fig. 3b viser et andet diagram for en tilstandsmaskine for visuel programmering af et legetøjselement;

fig. 3c viser et tredje diagram for afbrydelse af en tilstandsmaskine;

fig. 3d viser et fjerde diagram for start af en tilstandsmaskine;

fig. 4 viser parallel og sekventiel afvikling af programmer;

fig. 5 viser et første og et andet legetøjselement, hvor det første legetøjselement kan overføre data til det andet legetøjselement;

fig. 6 viser et rutediagram for lagring af programtrin;

- 5 fig. 7 viser et rutediagram for et program til at vælge en delmængde af programtrin fra en mængde af programtrin i afhængighed af et betjeningsvalg; og

fig. 8 viser en køretøjskonstruktion omfattende et mikroprocessorstyret legetøjsbyggeelement ifølge opfindelsen
10 koblet sammen med almindeligt kendte legetøjsbyggeelementer.

Fig. 1 viser et blokdiagram for et programmerbart legetøjselement. Legetøjselementet 101 omfatter en række elektroniske midler for programmering af legetøjselementet således, at det kan påvirke elektroniske enheder (for
15 eksempel motorer) i afhængighed af signaler opsamlet fra forskellige elektroniske sensorer (for eksempel elektriske kontakter).

Dermed kan legetøjselementet bringes til at udføre avancerede funktioner som for eksempel hændelsesstyret bevægelse, under forudsætning af at legetøjselementet kombi-
20 neres med de elektroniske enheder/sensorer på passende vis.

Legetøjselementet 101 omfatter en mikroprocessor 102, der
25 er forbundet til en række enheder via en kommunikationsbus 103. Via kommunikationsbussen 103 kan mikroprocessoren 102 modtage data fra to A/D omsættere 'A/D input #1' 105 og 'A/D input #2' 106. A/D omsætterne kan opsamle diskrete multibit signaler eller simple binære signaler.
30 Endvidere er A/D omsætterne indrettet til at kunne detektere passive værdier som for eksempel ohmsk modstand.

Mikroprocessoren 102 kan styre elektroniske enheder som for eksempel en elektromotor (ikke vist) via et sæt terminaler 'PWM output #1' 107 og 'PWM output #2' 108. I en foretrukken udførelsesform for opfindelsen styres de elektroniske enheder af et pulsbreddemoduleret signal.

Endvidere kan legetøjsselementet afgive lydssignaler eller lydsekvenser ved at styre en lyd giver 109, for eksempel en højttaler eller piezoelektrisk enhed.

Via lyskilden 'VL output' 110 kan legetøjsselementet afgive lyssignaler. Disse lyssignaler kan afgives ved hjælp af lysdioder. Lysdioderne kan for eksempel være indrettet til at indikere forskellige tilstande for legetøjsselementet og de elektroniske enheder/sensorer. Endvidere kan lyssignalerne benyttes som kommunikationssignaler til andre legetøjsselementer af en tilsvarende type. Lyssignalerne kan for eksempel benyttes til at overføre data til et andet legetøjsselement via en lysleder.

Via lysdetektoren 'VL input' 111 kan legetøjsselementet modtage lyssignaler. Disse lyssignaler kan blandt andet bruges til at detektere intensiteten af lyset i det rum legetøjsselementet befinder sig i. Lyssignalerne kan alternativt modtages via en lysleder og repræsentere data fra et andet legetøjsselement eller en personlig computer. Samme lysdetektor kan således have funktion for at kommunikere via en lysleder og for at fungere som lyssensor for detektering af intensiteten af lyset i det rum legetøjsselementet befinder sig i.

I en foretrukken udførelsesform er 'VL input' 111 indrettet til valgfrit enten at kommunikere via en lysleder eller alternativt, at detektere intensiteten af lyset i det rum legetøjsselementet befinder sig i.

Via den infrarøde lysdetektor 'IR input/output' 112 kan legetøjsselementet overføre data til andre legetøjsselementer eller modtage data fra andre legetøjsselementer eller for eksempel en personlig computer.

- 5 Mikroprocessoren 102 benytter en kommunikationsprotokol for modtagelse eller transmission af data. Transmission af data kan foretages ved at aktivere en speciel tastekombination

Displayet 104 og tasterne 'skift' 113, 'kør' 114, 'vælg' 10 115 og 'start/afbryd' 116 udgør en brugergrænseflade for betjening/programmering af legetøjsselementet. I en foretrukken udførelsesform er displayet et LCD display, der kan vise en række bestemte ikoner eller symboler. Symbolernes fremtoning på displayet kan styres individuelt, 15 for eksempel kan et ikon være synligt, være usynligt og bringes til at blinke.

Ved at påvirke tasterne kan legetøjsselementet programmeres samtidig med, at displayet giver en tilbagemelding til en bruger, om det program der er ved at blive genereret eller udført. Dette vil blive beskrevet nærmere i det 20 følgende. Idet brugergrænsefladen omfatter et begrænset antal elementer (det vil sige et begrænset antal ikoner og taster), opnås det at et barn, der skal lege med legetøjet hurtigt vil lære at betjene det.

- 25 Legetøjsselementet omfatter også en hukommelse 117 i form af RAM og ROM. Hukommelsen indeholder et operativsystem 'OS' 118 for styring af mikroprocessorens basale funktioner, en programstyring 'PS' 119, der kan styre afvikling af brugerspecificerede programmer, et antal regler 120, 30 hvor hver regel består af et antal bestemte instruktioner til mikroprocessoren og et program 121 i RAM, som udnytter de bestemte regler.

Reglerne kan udformes som delfprogrammer, der kan kaldes ved hjælp af funktionskald. Dette benævnes også 'scripting'. Et program (f.eks. brugerspecificeret) kan således sammensættes som en kombination af funktionskald. Ved
5 transmission af et program til et andet mikroprocessorstyret legetøjsbyggelement kan blot funktionskaldene overføres, hvis delfprogrammerne er kendte af det legetøjsbyggelement, der skal modtage programmet. Transmissi-
10 on af et program kan startes ved at aktivere en tastekombination eller ved at aktivere et særligt ikon på displayet 201.

I en foretrukken udførelsesform er legetøjsselementet baseret på en såkaldt single chip processor, der omfatter et antal ind- og udgange, hukommelse og en mikroprocessor
15 i et enkelt integreret kredsløb.

I en foretrukken udførelsesform omfatter legetøjsselementet lysdioder, der kan angive omløbsretning for tilsluttede motorer.

Fig. 2 viser et display på et legetøjsselement. Displayet
20 201 er indrettet til at vise et antal bestemte ikoner og er vist i en tilstand, hvor alle ikoner er gjort synlige. Ikonerne er inddelt med vandrette og lodrette bjælker 202 henholdsvis 203 i et antal grupper 204, 205, 206, 207 og 208 efter deres funktion.

25 Ikonerne kan for eksempel være udformet til at illustrere mulige bevægelsesmønstre for et køretøj. Et køretøj kan for eksempel konstrueres ved at kombinere legetøjsselementet med to motorer, der kan drive et hjulsæt i højre henholdsvis venstre side af et køretøj. Derved kan køretøjet
30 styres til at køre fremad, baglæns, til venstre og til højre. Endvidere kan køretøjet omfatte trykfølsomme kontakter for detektering af kollision og lysfølsomme sensorer.

I gruppen 204 er der ikoner for et lige og fremadrettet bevægelsesmønster, et fremadrettet zig-zag bevægelsesmønster, en cirkelbevægelse og en bevægelse, der gentager et givet mønster. Disse bevægelsesmønstre er ikke betinget af påvirkning af sensorer og er derfor ubetingede.

I gruppen 205 er der et første ikon for et bevægelsesmønster, der reverseres, når der detekteres en forhindring. Et andet ikon viser et lige og fremadrettet bevægelsesmønster, hvor den fremadrettede bevægelse blot korrigeres ved detektering af en forhindring. Et tredje ikon betinger igangsætning af et bevægelsesmønster. Et fjerde ikon stopper et igangværende bevægelsesmønster, når en tryksensor er aktiveret. Ikonerne i gruppen 205 repræsenterer således bevægelsesmønstre, der er betinget af trykfølsomme sensorer.

I gruppen 206 er der ikoner for at begynde et bevægelsesmønster, der søger mod den kraftigste lysintensitet henholdsvis et bevægelsesmønster, der søger mod den svageste lysintensitet. Lysintensiteten detekteres ved hjælp af lysfølsomme sensorer. Ikonerne i gruppen 205 repræsenterer således bevægelsesmønstre, der er betinget af lysfølsomme sensorer

I gruppen 207 er der tre identiske ikoner, som kan vises i kombination, for at angive med hvilken tidskonstant de omtalte bevægelsesmønstre skal udføres med. For eksempel kan zig-zag mønstret modificeres ved trinvist at ændre den tid, der skal gå før retningen ændres. Tidskonstanten kan for eksempel være 2 sekunder, 4 sekunder og 7 sekunder.

Gruppen 208 omfatter ikoner, der repræsenterer en række specielle effekter. Disse effekter kan for eksempel omfatte afgivelse af forskellige lyd- og lyssignaler even-

tuelst kombineret med en tilfældig påvirkning af de omtalte bevægelsesmønstre.

I det legetøjsselementet ifølge opfindelsen er et byggeelement, der kan kobles sammen med andre byggeelementer
5 er det særligt nemt at realisere de funktioner, der kan ses på ikonerne ved at bygge en konstruktion med et antal standardelementer.

Det skal bemærkes at displayet kan være af LCD type, LED type eller en anden type. Displayet kan desuden være indrettet til at vise forskellige former for tekstmeddelelser. Ikoner kan også være tekst.
10

Fig. 3a viser et første diagram for en tilstandsmaskine for visuel programmering af et legetøjsselement. Tilstandsmaskinen er implementeret som et program, der kan udføres af mikroprocessoren 102. Når tilstandsmaskinen ikke afvikler et brugerspecificeret program, og når legetøjsselementet er tændt, vil påvirkning af tasten 'vælg' flytte fokus fra en gruppe af ikoner til en anden gruppe af ikoner. Det at en gruppe af ikoner er i fokus kan vi-
15 ses ved at blinke med et ikon i en gruppe eller alle ikoner i en gruppe. Den viste tilstandsmaskine omfatter tre tilstande 301, 302 og 303 svarende til, at fokus kan skiftes mellem tre forskellige grupper af ikoner.
20

Tilstandsmaskinen skifter tilstand, når tasterne 'vælg' eller 'skift' aktiveres. Når tasten 'vælg' aktiveres skiftes mellem tilstandene 301, 302 og 303. Når tasten 'skift' aktiveres fortsætter tilstandsmaskinen i et andet sæt tilstande vist på fig. 3b.
25

Det skal bemærkes, at der kun er angivet tre tilstande i dette diagram svarende til tre grupper af ikoner på displayet 201. Dette er valgt for at gøre diagrammet overskueligt. I praksis må der være et antal tilstande sva-
30

rende til antallet af grupper af ikoner på displayet. Der kan endvidere være en tilstand for transmission af programmer.

Fig. 3b viser et andet diagram for en tilstandsmaskine for visuel programmering af et legetøjselement. Tilstandsmaskinen bliver bragt til disse tilstande, når tasten 'skift' aktiveres. Det antages, at en gruppe af ikoner er bragt i fokus. Når 'skift' aktiveres bringes tilstandsmaskinen i tilstand 304, hvor det første ikon i den gruppe, der er bragt i fokus vises - de andre ikoner i samme gruppe vises ikke.

Hvis tasten 'vælg' aktiveres, bringes tilstandsmaskinen i tilstand 305, hvor 'regel #1' vælges. 'regel #1' svarer til et sæt af instruktioner til mikroprocessoren 102, der kan udføre et bevægelsesmønster som vist på ikonet 'ikon #1'. Derefter bringes tilstandsmaskinen i tilstand 306, hvor fokus flyttes fra den aktuelle gruppe af ikoner til en næste gruppe af ikoner for valg af et ikon i denne gruppe.

Alternativt hvis tasten 'skift' vælges i tilstand 304 bringes tilstandsmaskinen i tilstand 307, hvor 'ikon #2' vises på displayet - de andre ikoner i samme gruppe vises ikke. Ligesom i tilstand 304 er det i tilstand 307 muligt at vælge en regel svarende til ikonet. Dette gøres ved at aktivere tasten 'vælg', hvorefter tilstandsmaskinen bringes i tilstand 308 for valg af regel 'regel #2'. Efterfølgende i tilstand 309 flyttes fokus til den næste gruppe af ikoner.

På tilsvarende vis kan 'ikon #3' vises i tilstand 310 ved aktivering af 'skift'. 'Regel #3' kan vælges ved aktivering af 'vælg', hvorefter fokus flyttes til en næste gruppe.

Ved endnu en aktivering af 'skift' i tilstand 310 vises alle ikoner i gruppen, hvorefter ikonerne i gruppen vises individuelt som beskrevet ovenfor.

5 I tilstandene 306, 309 og 312 vil aktivering af tasten 'skift' bringe tilstandsmaskinen i en af de respektive tilstande 302 eller 303 eller 301.

10 Det skal bemærkes, at det også er muligt ikke at vælge en regel i en eller flere grupper. I alternative udførelsesformer kan det desuden gøres muligt at vælge flere regler i samme gruppe.

Yderligere skal det bemærkes, at dette diagram svarer til et display med kun tre ikoner i hver gruppe. Dette er valgt for at gøre diagrammet overskueligt. I praksis må der være et antal tilstande svarende til antallet af ikoner i en given gruppe.

20 Generelt set vil aktivering af tasten 'kør' 114 bringe tilstandsmaskinen til en tilstand, hvor et program udføres - uanset antallet af valgte regler. Det er således ikke nødvendigt at spørge brugeren om programmet er færdigt eller ej.

Det er muligt at springe frem til en ønsket gruppe af ikoner for blot at ændre en regel i et brugerspecificeret program bestående af flere regler.

25 I en valgt tilstand for tilstandsmaskinen kan der transmitteres et specificeret program.

30 Fig. 3c viser et tredje diagram for afbrydelse af en tilstandsmaskine. Dette diagram viser, hvordan tilstandsmaskinen i tilstand 314 ved aktivering af 'afbryd' lagrer er repræsentation af den tilstand T som mikroprocessoren/tilstandsmaskinen befinder sig i. Derved er det muligt at genoptage et pludseligt afbrudt programmerings-

forløb uden at skulle starte forfra. I tilstand 315 slukkes legetøjsselementet.

Fig. 3d viser et fjerde diagram for start af en tilstandsmaskine. Dette diagram viser, hvordan tilstandsmaskinen ved aktivering af 'start' tænder legetøjs-
5 elementet i tilstand 316. Derefter hentes en tidligere lagret tilstandsrepræsentation T i tilstand 317. I tilstand 318 vises de ikoner, der repræsenterer tilstanden T. I tilstand 319 sættes fokus på ikonerne i gruppe 1,
10 hvorefter tilstandsmaskinen er klar til betjening som beskrevet i forbindelse med fig. 3a, 3b og 3c.

Som det fremgår af den ovenstående beskrivelse af fig. 3a, 3b, 3c og 3d, kan brugeren på simpel vis programmere legetøjsselementet til at udføre programmer, der omfatter
15 komplicerede funktioner. Programmerne genereres ved at sammensætte en række bestemte regler.

Den ovenfor omtalte tilstandsmaskine kan implementeres på en meget kompakt måde. Det er derved opnået at avancerede og brugerspecificerede funktioner kan udføres i afhængig-
20 hed af en simpel dialog med brugeren.

I de tilstande, hvor en regel vælges, det vil sige tilstandene 305, 308 og 311, udfører programsystemet 119 en række operationer, sådan at der genereres et brugerspecificeret program, som kan udføres af mikroprocessoren 102.

25 Det brugerspecificerede program kan genereres ved at lagre en reference (det vil sige en pointer) i hukommelsen 121, der refererer til en regel lagret i hukommelsen 120. Når flere regler vælges til at indgå i det samme brugerspecificerede program, lagres der en liste af referencer
30 til regler i hukommelsen 120 i hukommelsen 121. Et brugerspecificeret program kan således omfatte en eller flere regler.

Alternativt kan det brugerspecificerede program genereres ved at tage en kopi af hver af de valgte regler i hukommelsen 120 og indsætte kopierne i hukommelsen 121, derved vil hukommelsen 121 komme til at indeholde et komplet program. Endvidere kan det brugerspecificerede program genereres som en kombination af referencer til regler og instruktioner til mikroprocessoren 102.

Det skal bemærkes, at hver regel typisk omfatter et sæt af instruktioner, som kan betragtes som et delprogram, en funktion eller procedure. Men en regel kan også blot omfatte modificering af en parameter for eksempel en parameter, der angiver hastighed for en tilsluttet motor eller en tidskonstant.

I en hensigtsmæssig udførelsesform for opfindelsen kan der udføres en given handling, når tilstandsmaskinen skifter fra en første til en anden tilstand. En handling kan for eksempel omfatte signalering med lyd og/eller lys til brugeren for, at indikere hvilken tilstand eller type af tilstand legetøjselementet befinder sig i.

Fig. 4 viser parallel og sekventiel afvikling af programmer. Når der genereres et brugerspecificeret program kan reglerne afvikles som en sekvens af regler, parallelt eller i en kombination af sekventiel og parallel programafvikling.

Et eksempel på to regler der skal udføres parallelt i tid kan være en første regel om at et køretøj skal søge efter lys og en anden regel om at køretøjet skal ændre retning, når det detekterer forhindringer.

Et eksempel på to regler der skal udføres sekventielt i tid kan være en første regel om at et køretøj skal køre ligeud og en anden regel om at køretøjet skal køre i en cirkelbevægelse.

Reglerne R1 401, R2 402, R3 406, R4 405, R5 403 og R6 404 angiver et eksempel på en kombination af sekventiel og parallel programafvikling.

5 Når regler afvikles som delprogrammer, der udføres parallelt i tid, eller under en eller anden form for tidsdeling mellem delprogrammerne må situationer, hvor flere regler ønsker adgang til en ressource for eksempel i form af en motor kunne håndteres. I en foretrukken udførelsesform håndteres en sådan situation ved at tildele hver af
10 de regler, der kan vælges, et prioritetsnummer. For eksempel kan regler inden for samme gruppe af ikoner på displayet tildeles samme prioritetsnummer. Når operativsystemet 118 detekterer at to regler eller delprogrammer i et tidsrum begge ønsker adgang til en ressource afbrydes
15 eller stoppes den regel som har det laveste prioritetsnummer. Reglen med det højeste prioritetsnummer får derefter adgang til at benytte ressourcen. Hvis der kun kan vælges en regel fra samme gruppe af ikoner er der således opnået en entydig og forudsigelig programafvikling af
20 brugerspecificerede programmer.

Fig. 5 viser et første og et andet legetøjsselement, hvor det første legetøjsselement kan overføre programmer til det andet legetøjsselement. Det første legetøjsselement 501 omfatter en mikroprocessor 507, et I/O modul 510, en hukommelse 509 og en brugergrænseflade 508. Endvidere omfatter legetøjsselementet 501 en to-vejs kommunikationsenhed 506 for kommunikation via en infrarød sender/modtager 505 eller for kommunikation ved hjælp af en lyskilde/lysdetektor 504, der kan udsende og detektere synligt
25 lys.
30

Tilsvarende omfatter det andet legetøjsselement 502 en mikroprocessor 514, et I/O modul 515 og en hukommelse 516. Endvidere omfatter legetøjsselementet 502 en kommunikati-

onsenhed 513 for kommunikation via en infrarød sender/modtager 512 eller for kommunikation ved hjælp af en lyskilde/lysdetektor 511, der kan udsende og detektere synligt lys.

- 5 I en foretrukken udførelsesform for opfindelsen kan det første legetøjselement både sende og modtage data, hvorimod det andet legetøjselement kun kan modtage data.

Data kan overføres som synligt lys via en lysleder 503. Alternativt kan data overføres som infrarødt lys 517 og
10 518. Data kan være i form af koder, der angiver en specifik instruktion og tilhørende parametre, der kan fortolkes af mikroprocessorerne 507 og/eller 514. Alternative kan data være i form af koder der referere til et delprogram eller regel lagret i hukommelsen 516.

- 15 I/O modulerne 510 og 515 kan forbindes til elektroniske enheder (for eksempel motorer) for styring af disse. I/O modulerne 510 og 515 kan også forbindes til elektroniske sensorer, således at enhederne kan styres i afhængighed af detekterede signaler.

- 20 I en foretrukken udførelsesform er fiberen 503 indrettet således at en del af det synlige lys, den transmitterer slipper ud gennem fiberen. Derved er det muligt for en bruger - direkte - at følge med i transmissionen. Brugeren kan for eksempel se hvornår kommunikationen starter
25 og stopper.

Lyset gennem fiberen kan overføre data med en given data-transmissionsfrekvens som skift i lysniveauet i fiberen. Data kan transmitteres således at det er muligt for brugeren at observere enkelte lysniveauskift under en transmission (det vil sige ved en passende lav datatransmissionsfrekvens) eller blot at se om transmissionen er i gang

30

(det vil sige ved en passende høj datatransmissionsfrekvens).

Almindeligvis er det uønsket at en del af det lys, der skal transmitteres gennem fiberen slipper ud gennem fiberen. Men i forbindelse med kommunikation mellem to legetøjselementer er det en ønsket effekt, da det således er muligt at følge med i kommunikationen på en meget intuitiv måde.

Der er kendt for en fagmand, hvordan det opnås at en del af lyset slipper ud gennem fiberen. Det kan for eksempel lade sig gøre ved at tilføre urenheder til fiberens kappe eller ved at lave mekaniske hak eller mønstre i fiberen. Den del af lyset, der skal slippe ud gennem fiberen kan også styres ved at styre forholdet mellem brydningsindeks i en lysleders kerne og kappe.

I det følgende beskrives det hvordan et program kan modtages i legetøjselementet 502 når dette er i en tilstand $R=P$.

Fig. 6 viser et rutediagram for lagring af programtrin. Rutediagrammet viser hvorledes en bruger kan lagre egne regler overført fra en ekstern enhed for eksempel et andet legetøjselement som angivet ovenfor eller fra en personlig computer. I en udførelsesform overføres kun referencer til de regler der er lagret i legetøjselementet. Dermed reduceres den nødvendige båndbredde for kommunikation mellem legetøjselementerne. I trin 602 undersøges det om der modtages download-signaler fra eksterne enheder. Hvis det er tilfældet undersøges det i trin 603 om download-signalerne er valide. Hvis signalerne ikke er valide (nej) afspilles en lyd, der indikerer fejl, i trin 604. Er signalerne valide (ja) undersøges det om signalerne skal fortolkes som kommandoer, der skal udføres med det samme (udfør) eller om signalerne skal fortolkes som

kommandoer, der skal lagres med henblik på senere eksekvering (gem). Hvis kommandoerne skal udføres med det samme udføres disse i trin 606, hvorefter programmet returnerer til trin 602. Hvis kommandoerne skal lagres
 5 spilles en anerkendelseslyd i trin 607 og kommandoen lagres som et programtrin i trin 608 i lageret 609.

Som eksempel på en kommando, der skal udføres med det samme kan være at kommandoerne i lagret 609 skal eksekveres.

- 10 I en alternativ udførelsesform kan brugerens egne regler dannes ved at sætte en kombination af eksisterende regler sammen uden brug af en ekstern enhed.

I det følgende gives der eksempler på mulige funktioner for en række regelbaserede programmer R1-R7 (regel 1, regel 2, regel 3, regel 4, regel 5, regel 6 og regel 7).
 15

Regel 1:

- 1) Pause på 1 sekund.
- 2) En lydsekvens (startlyd) bliver afspillet.
- 20 3) 0,5 sekunds pause.
- 4) En lydsekvens (bagud lyd) bliver afspillet.
- 5) Motoren kører bagud i 5 sekunder.
- 6) Motoren stopper.
- 7) Punkt 3 - 6 gentages 2 gange (3 ialt)
- 25 8) Reglen stoppes.

Regel 2:

- 9) Pause på 1 sekund.
- 30 10) En lydsekvens (startlyd) bliver afspillet.
- 11) 0,5 sekunds pause.
- 12) En lydsekvens (bagud lyd) bliver afspillet.
- 13) Motoren kører bagud i 5 sekunder.
- 14) Motoren stopper.
- 35 15) 0,5 sekunds pause.
- 16) En lydsekvens (fremad lyd) bliver afspillet.
- 17) Motoren kører fremad i 5 sekunder.
- 18) Motoren stopper.
- 19) Punkt 3 - 10 gentages 2 gange (3 ialt)
- 40 20) Reglen stoppes

Regel 3:

- 1) Pause på 1 sekund.
- 2) En lydsekvens (kalibrer lyd) bliver afspillet.
- 3) En lydsekvens (startlyd) bliver afspillet.
- 5 4) En lydsekvens (bagud lyd) bliver afspillet.
- 5) Motoren kører baglæns i maximum 7 sekunder.
- 6) Hvis der er detekteret lys inden de 7 sekunder er gået (punkt 5):
 - Motor stopper.
 - 10 - Fremad lydsekvens afspilles.
 - Motor kører fremad så længe lys detekteres
 - Hvis lys forsvinder:
 - i. Motor stopper efter 0,5 sekund.
 - ii. Hvis lyset kommer igen indenfor 2 se-
 - 15 kunder starter motoren igen.
 - iii. Hvis lyset forbliver borte i 2 sekun-
 - der - forbliver motoren slukket.
- 7) Punkt 4 - 6 gentages så længe at lys detekteres in-
- 20 denfor de 7 sekunder og indtil at 3 forsøg uden lys
- er foretaget.
- 8) Motoren stopper.
- 9) Regelen stopper.

Eksempel på brugerens oplevelse: En model konstrueres så-

25 ledes at når modellen kører bagud drejer modellen og når

den kører fremad kører den ligeud. Regelen giver derfor

en søg lys funktion - når bruger lyser på modellen kører

modellen frem mod brugeren.

Fig. 7 viser et rutediagram for et program til at vælge

30 en delmængde af programtrin fra en mængde af programtrin

i afhængighed af et betjeningsvalg. Betjeningsvalget kan

for eksempel foregå ved at betjene kontakten 111. Rutedi-

agrammet starter i trin 700. Derefter vælges en delmængde

af programtrin. En delmængde af programtrin benævnes også

35 en regel. I 701 vælges regel R ud af en samling af forud-

bestemte regler R1-R7 i form af regelbaserede programmer

lagret i hukommelsen 110. I trin 702 afgøres det om den

valgte regel er regel R=R1. Hvis det er tilfældet (ja)

udføres det regelbaserede program R1 i trin 703. Alterna-

40 tivt (nej) undersøges det om regel R=R2 blev valgt. Til-

svarende afgøres det i trinene 704, 706 og 708 om den

valgte regel er regel 2, 3 eller 7 og der udføres respektive regelbaserede programmer i trin 705, 707 eller 709. Det er således muligt at vælge en af flere forudbestemte regler. Disse regler kan for eksempel være bestemt af
5 producenten af legetøjsselementet.

Som beskrevet ovenfor er det muligt at lagre brugerdefinerede regler ved at kombinere de forudbestemte regler.

Fig. 8 viser en køretøjskonstruktion omfattende et mikroprocessorstyret legetøjsbyggeelement ifølge opfindelsen
10 koblet sammen med almindeligt kendte legetøjsbyggeelementer. Det mikroprocessorstyrede legetøjsbyggeelement 801 er koblet oven på en konstruktion 805 af byggeelementer og to motorer (ikke vist). Motorerne driver et hjul i hver side af køretøjet, hvoraf kun hjul 804 på den ene
15 side af køretøjskonstruktionen kan ses. Hjulene drives af en aksler 804 der via tandhjul 803 er forbundet til motorerne. Motorerne er elektrisk forbundet til legetøjsbyggeelementet 801 ved hjælp af ledninger 815.

Køretøjskonstruktionen omfatter endvidere to bevægelige
20 arme 806, der kan drejes omkring et leje 807 således at armene ved drejning kan bringes til at påvirke et sæt kontakter 808. Kontakterne 808 er elektrisk forbundet til legetøjsselementet 801 via ledninger 809.

Legetøjsselementet kan betjenes via tasterne 813. Display-
25 et 812 kan vise information som beskrevet ovenfor i forbindelse med fig. 2. Legetøjsselementet 801 har et sæt elektriske kontaktflader 810 og 811 hvortil ledningerne 809 og 815 kan tilkobles for henholdsvis modtagelse og afgivelse af signaler.

30 Ved passende programmering af legetøjsselementet 801 kan køretøjet bringes til at køre uden om forhindringer, der kan påvirke armene 806.

PATENTKRAV

1. Mikroprocessorstyret legetøjsbyggeelement (101,501) omfattende
- 5 en mikroprocessor (102,507), der kan udføre instruktioner i form af et program lagret i en hukommelse (117,509), hvor hukommelsen omfatter delprogrammer (R1,R2,...,R6), som kan aktiveres individuelt ved at specificere en liste af delprogramkald;
- 10 koblingsmidler for sammenkobling med byggeelementer, der kan bevæges ved hjælp af aktiveringsorganer, hvor aktiveringsorganerne kan styres i afhængighed af instruktionerne,
- k e n d e t e g n e t ved, at omfatte
- 15 kommunikationsmidler (504,505), der kan transmittere nævnte funktionskald til et andet legetøjsbyggeelement (502) for programmering af dette.

2. Mikroprocessorstyret legetøjsbyggeelement ifølge krav
1 k e n d e t e g n e t ved, at omfatte et display
(104,508) der kan vise et antal ikoner
(204,205,206,207,208), som hver især repræsenterer in-
5 struktioner til mikroprocessoren (102,507), og som kan
aktiveres af en bruger for programmering af mikroproces-
soren.
3. Mikroprocessorstyret legetøjsbyggeelement ifølge krav
1-2, k e n d e t e g n e t ved at instruktioner, svaren-
10 de til et ikon, implementerer en regel (R1,R2,...,R6) ved
at styre aktiveringsorganerne i afhængighed af signaler
fra sensorer forbundet til legetøjsbyggeelement.
4. Mikroprocessorstyret legetøjsbyggeelement ifølge krav
1-2, k e n d e t e g n e t ved at omfatte en modtager
15 (504,505) til trådløs modtagelse af instruktioner.
5. Mikroprocessorstyret legetøjsbyggeelement ifølge krav
1-2, k e n d e t e g n e t ved at omfatte en modtager
(505) til modtagelse af infrarøde signaler.
6. Mikroprocessorstyret legetøjsbyggeelement ifølge krav
20 1-2, k e n d e t e g n e t ved at omfatte et tastatur
til manuel indtastning af instruktioner.
7. Mikroprocessorstyret legetøjsbyggeelement ifølge krav
1-2, k e n d e t e g n e t ved at omfatte en sender
(504,505) til trådløs transmission af instruktioner til
25 det andet legetøj.
8. Mikroprocessorstyret legetøjsbyggeelement ifølge krav
1-2, k e n d e t e g n e t ved at omfatte en sender
(504) til transmission af nævnte funktionskald via en
lysleder (503).
- 30 9. Mikroprocessorstyret legetøjsbyggeelement ifølge krav
1-2, k e n d e t e g n e t ved at omfatte en langstrakt

lysleder (503), hvorigennem der kan transmitteres synligt lys i dens længderetning, og hvor lyslederen (503) er indrettet til at lade en del af det lys, der transmitteres slippe ud gennem dens sider.

- 5 10. Legetøjsbyggesæt omfattende mikroprocessorstyrede legetøjsbyggeelementer ifølge et vilkårligt af kravene 1-9 k e n d e t e g n e t ved at omfatte et første og et andet mikroprocessorstyret legetøjsbyggeelement (501,502), hvor det andet mikroprocessorstyrede legetøjsbyggeelement
- 10 (502) omfatter en hukommelse (516) med delprogrammer (R1,R2,...,R6), som kan aktiveres individuelt ved at modtage delprogramkald fra det første legetøjsbyggeelement (501).

- 15 11. Legetøjsbyggesæt ifølge krav 10 k e n d e t e g n e t ved at det første mikroprocessorstyrede legetøjsbyggeelement omfatter betjeningsmidler (508) til at lave et program og ved at det andet mikroprocessorstyrede legetøjsbyggeelement omfatter betjeningsmidler til at aktivere kun et af flere programmer.

SAMMENDRAG

Programmerbart legetøj med en modtager til modtagelse af instruktioner til programmering af legetøjet, samt midler til udførelse af modtagne instruktioner. Legetøjet har en sender til transmission af instruktioner til et andet legetøj.

(fig. 5)



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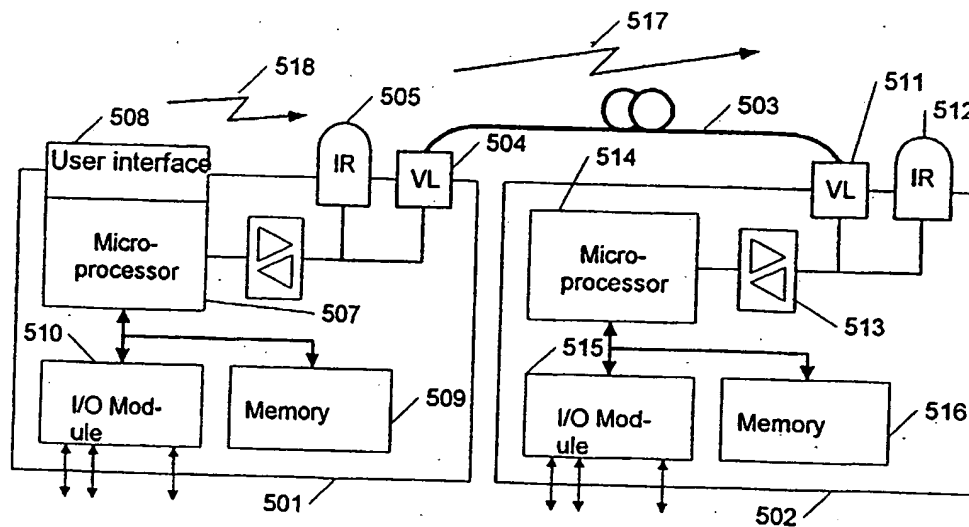
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(57) Abstract

A programmable toy with a receiver for receiving instructions for programming of the toy, and means for executing received instructions. The toy has a transmitter for transmission of instructions to a second toy.

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A programmable toy with communication means

The invention relates to a microprocessor controlled toy building element comprising a microprocessor which can execute instructions in the form of a program stored in a memory, said memory comprising subprograms which can be activated individually by specifying a list of subprogram calls; coupling means for coupling with building elements which can be moved by activation means, said activation means being controllable in response to the instructions.

In connection with the development of small, sophisticated and relatively inexpensive microprocessors it has become attractive to use these in many different consumer products - including toys. Generally, the development of toys has proceeded from simple functions such as playing of sounds in dolls, performance of simple patterns of movement in robots, etc., to the development of toys with sophisticated patterns of action and a form of behaviour.

Such toy building elements can perform different physical actions partly by programming the toy building element and partly by building a structure which consists of interconnected toy building elements of different types. Thus, there are numerous combination possibilities of making structures and giving the structures various functions. The physical actions may be unconditional and comprise simple or complex movements controlled by an electric motor as well as emission of light and sound signals. The physical actions may also be conditioned by the interaction of the toy with its surroundings, and the toy may then be programmed to respond to physical contact with an object or to light and optionally sound and to change its behaviour on the basis of such an interaction.

Such programmable toys are known e.g. from the product
ROBOTICS INVENTION SYSTEM from LEGO MINDSTORMS, which is
a toy which can be programmed by a computer to make un-
5 conditioned as well as conditioned actions.

CA 2,225,060 relates to interactive toy elements; a first
toy element activated by a user can activate a second toy
element, which can in turn activate the first toy element
10 or a third toy element. The toy elements may be in the
form of dolls, animals or a car which can perform activi-
ties.

However, it is a problem of this toy that the toy re-
15 quires an external computer for the user-defined programs
to be transferred to such a microprocessor controlled toy
element. It has been a prejudice within the prior art
that exchange of programs between toy elements is rele-
vant only between identical toy elements, since, other-
20 wise, the interaction between a program and a mechanical
structure will involve possibilities of error.

Within the field of construction toys it is a typical
situation that structures are built and modified repeat-
25 edly. Since this is part of the game, there is thus a
need for the ability to activate a new program adapted to
the specific structure.

Accordingly, an object of the invention is to provide a
30 microprocessor controlled toy building element having
more flexible programming functions.

This is achieved when the microprocessor controlled toy
building element mentioned initially is characterized by

comprising communications means which can transmit said function call to a second toy building element for programming of it.

5 Thereby, a first microprocessor controlled toy building element can transmit a list of function calls to a second microprocessor controlled toy building element. When the second toy building element has stored subprograms known by the first toy building element, programs can rapidly
10 be exchanged between two toy building elements. Thereby the potential of construction toys based on the functionality between a plurality of standard building elements in a structure and a plurality of standard program steps may be utilized in an effective manner.

15

A preferred embodiment of the invention will be described below with reference to the drawing, in which

fig. 1 shows a block diagram of a programmable toy ele-
20 ment;

fig. 2 shows a display on a toy element;

fig. 3a shows a first diagram of a state machine for vis-
25 ual programming of a toy element;

fig. 3b shows a second diagram of a state machine for visual programming of a toy element;

30 fig. 3c shows a third diagram for interrupting a state machine;

fig. 3d shows a fourth diagram for starting a state machine;

fig. 4 shows parallel and sequential execution of programs;

- 5 fig. 5 shows first and second toy elements, where the first toy element can transfer data to the second toy element;

fig. 6 shows a flow chart for storing program steps;

10

fig. 7 shows a flow chart for a program for selecting a subset of program steps from a set of program steps in response to an operation selection; and

- 15 fig. 8 shows a toy structure comprising a microprocessor controlled toy building element according to the invention coupled with generally known toy building elements.

20 Fig. 1 shows a block diagram of a programmable toy element. The toy element 101 comprises a plurality of electronic means for programming the toy element so that it can affect electronic units (e.g. motors) in response to signals picked up from various electronic sensors (e.g. electrical switches).

25

The toy element may hereby be caused to perform sophisticated functions such as e.g. action controlled movement, provided that the toy element is combined with the electronic units/sensors in a suitable manner.

30

The toy element 101 comprises a microprocessor 102 which is connected to a plurality of units via a communications bus 103. The microprocessor 102 can receive data via the communications bus 103 from two A/D converters "A/D input

#1" 105 and "A/D input #2" 106. The A/D converters can pick up discrete multibit signals or simple binary signals. Further, the A/D converters are adapted to detect suitable values such as e.g. ohmic resistance.

5

The microprocessor 102 can control electronic units such as e.g. an electric motor (not shown) via a set of terminals "PWM output #1" 107 and "PWM output #2" 108. In a preferred embodiment of the invention the electronic
10 units are controlled by a pulse width modulated signal.

Moreover, the toy element can emit sound signals or sound sequences by controlling a sound generator 109, e.g. a loudspeaker or piezoelectric unit.

15

The toy element can emit light signals via the light source "VL output" 110. These light signals can be emitted by means of light emitting diodes. The light emitting diodes may e.g. be adapted to indicate various states of
20 the toy element and the electronic units/sensors. The light signals may furthermore be used as communications signals for other toy elements of a corresponding type. The light signals may e.g. be used for transferring data to a second toy element via a light guide.

25

The toy element can receive light signals via the light detector "VL input" 111. These light signals may be used inter alia for detecting the intensity of the light in the room in which the toy element is present. The light
30 signals may alternatively be received via a light guide and represent data from a second toy element or a personal computer. The same light detector may thus have the function of communicating via a light guide and of serv-

ing as a light sensor for detecting the intensity of the light in the room in which the toy element is present.

5 In a preferred embodiment, the "VL input" 111 is adapted to selectively either communicate via a light guide or alternatively to detect the intensity of the light in the room in which the toy element is present.

10 Via the infrared light detector "IR input/output" 112 the toy element can transfer data to other toy elements or receive data from other toy elements or e.g. a personal computer.

15 The microprocessor 102 uses a communications protocol for receiving or transmitting data. Transmission of data may take place by activating a special key combination.

20 The display 104 and the keys "shift" 113, "run" 114, "select" 115 and "start/interrupt" 116 constitute a user interface for operating/programming the toy element. In a preferred embodiment, the display is an LCD display that can show a plurality of specific icons or symbols. The appearance of the symbols on the display may be controlled individually, e.g. an icon may be visible, be invisible and be caused to flash.

30 By affecting the keys the toy element may be programmed at the same time as the display provides feedback to a user about the program which is being generated or executed. This will be described more fully below. As the user interface comprises a limited number of elements (that is a limited number of icons and keys), it is ensured that a child who wants to play with the toy will quickly learn how to operate it.

The toy element also comprises a memory 117 in the form of RAM or ROM. The memory contains an operating system "OS" 118 for control of the basic functions of the micro-processor, a program control "PS" 119 capable of controlling the execution of user-specified programs, a plurality of rules 120, each rule consisting of a plurality of specific instructions for the microprocessor, and a program 121 in RAM which utilizes the specific rules.

10

The rules may be designed as subprograms which may be called by a function call. This is also called scripting. A program (e.g. a user-specified one) may thus be designed as a combination of function calls. When transmitting a program to another microprocessor controlled toy building element, merely the function calls may be transferred, if the subprograms are known by the toy building element which is to receive the program. Transmission of a program may be started by activating a key combination or by activating a special icon on the display 201.

15
20

In a preferred embodiment, the toy element is based on a so-called single chip processor which comprises a plurality of inputs and outputs, a memory and a microprocessor in a single integrated circuit.

25

In a preferred embodiment, the toy element comprises light emitting diodes which can indicate the direction of revolution of the connected motors.

30

Fig. 2 shows a display on a toy element. The display 201 is adapted to show a plurality of specific icons and is shown in a state in which all the icons have been made visible. The icons are divided by horizontal and vertical

beams 202 and 203, respectively, into a plurality of groups 204, 205, 206, 207 and 208 according to their function.

- 5 The icons may e.g. be designed to illustrate possible patterns of movement for a vehicle. A vehicle may e.g. be constructed by combining the toy element with two motors which can drive a set of wheels at the right-hand side and the left-hand side, respectively, of a vehicle. The
- 10 vehicle may hereby be controlled to drive forwards, backwards, to the left and to the right. Further, the vehicle may comprise pressure-sensitive switches for detecting collision and light-sensitive sensors.
- 15 The group 204 includes icons for a straight and forwardly directed pattern of movement, a forwardly directed zigzag pattern of movement, a circular movement and a movement which repeats a given pattern. These patterns of movement are not conditioned by the action of sensors and are
- 20 therefore unconditioned.

- The group 205 includes a first icon for a pattern of movement, which is reversed when an obstacle is detected. A second icon shows a straight and forwardly directed
- 25 pattern of movement, where the forwardly directed movement is merely corrected by the detection of an obstacle. A third icon conditions initiation of a pattern of movement. A fourth icon stops an ongoing pattern of movement when a pressure sensor is activated. The icons in the
- 30 group 205 thus represent patterns of movement which are conditioned by pressure-sensitive sensors.

The group 206 includes icons for starting a pattern of movement which moves toward the strongest light intensity

and a pattern of movement which moves toward the weakest light intensity, respectively. The light intensity is detected by means of light-sensitive sensors. The icons in the group 205 thus represent patterns of movement which
5 are conditioned by light-sensitive sensors.

The group 207 includes three identical icons which can be displayed in combination to indicate the time constant at which the mentioned patterns of movement are to be per-
10 formed. For example, the zigzag pattern may be modified by stepwise changing the period of time which has to elapse before the direction is changed. The time constant may e.g. be 2 seconds, 4 seconds and 7 seconds.

15 The group 208 comprises icons which represent a plurality of special effects. These effects may e.g. comprise emission of various sound and light signals optionally combined with an arbitrary activation of the mentioned patterns of movement.

20 As the toy element of the invention includes a building element which may be coupled with other building elements, it is particularly easy to realize the functions which can be seen on the icons by building a structure
25 with a plurality of standard elements.

It should be noted that the display may be of LCD type, LED type or another type. The display may moreover be adapted to show various forms of text messages. Icons may
30 also be text.

Fig. 3a shows a first diagram of a state machine for visual programming of a toy element. The state machine is implemented as a program which can be executed by the mi-

croprocessor 102. When the state machine does not execute a user-specified program, and when the toy element has been turned on, activation of the key "select" will direct focus from one group of icons to another group of icons. That a group of icons is in focus may be shown by flashing an icon in a group or all the icons in a group. The state machine shown comprises three states 301, 302 and 303 corresponding to switching focus between three different groups of icons.

10

The state machine changes states when the keys "select" or "shift" are activated. When the key "select" is activated, switching takes place between the states 301, 302 and 303. When the key "shift" is activated, the state machine continues in another set of states, as shown in fig. 3b.

15

It should be noted that just three states are indicated in this program, corresponding to three groups of icons on the display 201. This has been chosen in order to make the diagram readily understandable. In practice, there must be a number of states corresponding to the number of groups of icons on the display. Further, there may be a state for the transmission of programs.

25

Fig. 3b shows a second diagram of a state machine for visual programming of a toy element. The state machine is caused to assume these states when the key "shift" is activated. It is assumed that a group of icons has been focused. When "shift" is activated, the state machine assumes the state 304 in which the first icon in the group which has been focused is activated - the other icons in the same group are not shown.

30

If the key "select" is activated, the state machine assumes the state 305 where "rule #1" is selected. "Rule #1" corresponds to a set of instructions for the micro-processor 102 which can perform a pattern of movement as shown on the icon "icon #1". Then the state machine assumes the state 306 where focus is moved from the current group of icons to another group of icons for the selection of an icon in this group.

10 Alternatively, if the key "shift" is selected in the state 304, the state machine assumes the state 307, where the "icon #2" is shown on the display - the other icons in the same group are not shown. Like in the state 304, it is possible in the state 307 to select a rule corresponding to the icon. This is done by activating the key "select", and then the state machine assumes the state 15 308 for the selection of the rule "rule #2". Subsequently, in state 309 focus is moved to the next group of icons.

20 Correspondingly, "icon #3" may be displayed in state 310 by activation of "shift". "Rule #3" may be selected by activation of "select", following which focus is moved to another group.

25 A further activation of "shift" in the state 310 causes all the icons in the group to be shown, and then the icons in the group are shown individually as described above.

30 In the states 306, 309 and 312, activation of the key "shift" will cause the state machine to assume one of the respective states 302 or 303 or 301.

It should be noted that it is also possible not to select a rule in one or more groups. In alternative embodiments, it can moreover be made possible to select several rules in the same group.

5

Additionally, it should be noted that this diagram corresponds to a display with just three icons in each group. This has been chosen to make the diagram readily understandable. In practice, there must be a number of states

10

corresponding to the number of icons in a given group.

Generally, activation of the key "run" 114 will cause the state machine to assume a state in which a program is executed - irrespective of the number of selected rules.

15

Thus, it is not necessary to ask the user whether the program is ready or not.

It is possible to jump to a desired group of icons in order just to change a rule in a user-specified program consisting of several rules.

20

In a selected state of the state machine, a specified program can be transmitted.

25

Fig. 3c shows a third program for the interruption of a state machine. This program shows how the state machine in state 314, upon activation of "interrupt", stores a representation of the state T in which the microprocessor/state machine is present. It is hereby possible to

30

resume a suddenly interrupted programming course without having to start from scratch. The toy element is turned off in state 315.

Fig. 3d shows a fourth diagram for starting a state machine. This program shows how the state machine, upon activation of "start", turns on the toy element in state 316. Then, a previously stored state representation T is
5 retrieved in state 317. In state 318, the icons representing the state T are shown. In state 319, the icons in group 1 are focused, and then the state machine is ready for operation as described in connection with figs. 3a, 3b and 3c.

10

As will appear from the above description of figs. 3a, 3b, 3c and 3d, the user can program the toy element in a simple manner to execute programs which comprise complicated functions. The programs are generated by combining
15 a number of specific rules.

The state machine described above may be implemented in a very compact manner. It is ensured hereby that sophisticated and user-specified functions can be performed in
20 response to a simple dialogue with the user.

In the states where a rule is selected, that is the states 305, 308 and 311, the program system 119 executes a number of operations, thereby generating a user-specified program which can be executed by the microprocessor
25 102.

The user-specified program can be generated by storing a reference (that is a pointer) in the memory 121 which refers to a rule stored in the memory 120. When several
30 rules are selected to be included in the same user-specified program, a list of references to rules in the memory 120 is stored in the memory 121. A user-specified program may thus comprise one or more rules.

Alternatively, the user-specified program may be programmed by making a copy of each of the selected rules in the memory 120 and inserting the copies into the memory 5 121; the memory 121 will hereby contain a complete program. Furthermore, the user-specified program may be generated as a combination of references to rules and instructions to the microprocessor 102.

10 It should be noted that each rule typically comprises a set of instructions which may be considered a subprogram, a function or a procedure. But a rule may also just comprise modification of a parameter e.g. a parameter which indicates the speed of a connected motor or a time constant. 15

In an expedient embodiment of the invention, a given action may be performed when the state machine changes from a first state to a second state. An action may e.g. comprise 20 signalling with sound and/or light to the user to indicate the state or type of state which the toy element has assumed.

Fig. 4 shows parallel and sequential execution of programs. When a user-specified program is generated, the rules may be executed as a sequence of rules, in parallel 25 or in a combination of sequential and parallel program execution.

30 An example of two rules to be executed in parallel in time may be a first rule that a vehicle is to search for light, and a second rule that the vehicle is to change its direction when it detects obstacles.

An example of two rules to be performed sequentially in time may be a first rule that the vehicle is to drive straight ahead, and a second rule that the vehicle is to drive in a circular movement.

5

Rules R1 401, R2 402, R3 406, R4 405, R5 403 and R6 404 provide an example of a combination of sequential and parallel program execution.

- 10 When rules are executed as subprograms run in parallel in time, or in some form of time division between the subprograms, it must be possible to handle situations in which several rules want access to a resource e.g. in the form of a motor. In a preferred embodiment, such a situation is handled by allocating a priority number to each
- 15 of the rules which may be selected. For example, rules within the same group of icons on the display may be given the same priority number. When the operating system 118 detects that two rules or subprograms both want access to a resource within a period of time, the rule having the lowest priority number is interrupted or stopped. The rule with the highest priority number is then allowed to use the resource. If only one rule can be selected from the same group of icons, a unique and predictable
- 20 program execution of user-specified programs is thus achieved.
- 25

Fig. 5 shows first and second toy elements, where the first toy element can transfer programs to the second toy element. The first toy element 501 comprises a microprocessor 507, a I/O module 510, a memory 509 and a user interface 508. The toy element 501 moreover comprises a two-way communications unit 506 for communication via an infrared transmitter/receiver 505 or for communication by

30

means of a light source/light detector 504 which can emit and detect visible light.

Correspondingly, the second toy element 502 comprises a
5 microprocessor 514, a I/O module 515 and a memory 516.
The toy element 502 moreover comprises a communications
unit 513 for communication via an infrared transmitter/receiver 512 or for communication by means of a light
source/light detector 511 which can emit and detect
10 visible light.

In a preferred embodiment of the invention, the first toy
element can both transmit and receive data, while the
second toy element can only receive data.

15 Data can be transferred as visible light via a light
guide 503. Alternatively, data may be transferred as in-
frared light 517 and 518. Data may be in the form of
codes that indicate a specific instruction and associated
20 parameters which can be interpreted by the microproces-
sors 507 and/or 514. Alternatively, data may be in the
form of codes which refer to a subprogram or rule stored
in the memory 516.

25 The I/O modules 510 and 515 may be connected to elec-
tronic units (e.g. motors) for control of these. The I/O
modules 510 and 515 may also be connected to electronic
sensors so that the units may be controlled in response
to detected signals.

30 In a preferred embodiment, the fibre 503 is adapted such
that part of the visible light transmitted by it escapes
from the fibre. It is hereby possible for a user - di-

rectly - to watch the transmission. The user can e.g. see when the communication begins and stops.

5 The light through the fibre can transfer data with a given data transmission frequency as changes in the light level in the fibre. Data may be transmitted such that it is possible for the user to observe individual light level changes during a transmission (that is at a suitably low data transmission frequency), or merely by seeing whether the transmission is going on (that is at a suitably high data transmission frequency).

15 Generally, it is undesirable that part of the light to be transmitted through the fibre escapes from the fibre. But in connection with communication between two toy elements, it is a desired effect, since it is then possible to watch the communication in a very intuitive manner.

20 It is known to a skilled person how to ensure that part of the light escapes from the fibre. It can e.g. be done by imparting impurities to the sheath of the fibre, or by making mechanical notches or patterns in the fibre. The part of the light which is to escape from the fibre may also be controlled by controlling the ratio of the refractive index of a core to that of a sheath of a light guide.

25 It will be described below how a program may be received in the toy element 502 when this is in a state R=P.

30

Fig. 6 shows a flow chart for the storage of program steps. The flow chart shows how a user can store own rules transferred from an external unit for example a second toy element, as stated above, or from a personal

computer. In an embodiment, only references to the rules stored in the toy element are transferred. This reduces the necessary bandwidth for communication between the toy elements. It is checked in step 602 whether download signals are received from external units. If this is the case, it is checked in step 603 whether the download signals are valid. If the signals are not valid (no), a sound indicating an error is played in step 604. If the signals are valid (yes), it is checked whether the signals are to be interpreted as commands which are to be executed at once (execute), or whether the signals are to be interpreted as commands which are to be stored with a view to subsequent execution (save). If the commands are to be executed at once, this is done in step 606, and then the program returns to step 602. If the commands are to be stored, a recognition sound is played in step 607 and the command is stored as a program step in step 608 in the storage 609.

20 An example of a command to be carried out at once may be that the commands in the storage 609 are to be executed.

In an alternative embodiment, the user's own rules may be formed by making a combination of existing rules without using an external unit.

Examples of possible functions of a number of rule based programs R1-R7 are given below (rule 1, rule 2, rule 3, rule 4, rule 5, rule 6 and rule 7).

30

Rule 1:

- 1) A pause of 1 second.
- 2) A sound sequence (start sound) is played.

- 3) A pause of 0.5 second.
- 4) A sound sequence (backward sound) is played.
- 5) The motor runs backwards for 5 seconds.
- 6) The motor stops.
- 5 7) Points 3-6 are repeated twice (3 times in all).
- 8) The rule is stopped.

Rule 2:

- 10 9) A pause of 1 second.
- 10) A sound sequence (start sound) is played.
- 11) A pause of 0.5 second.
- 12) A sound sequence (backward sound) is played.
- 13) The motor runs backwards for 5 seconds.
- 15 14) The motor stops.
- 15) A pause of 0.5 second.
- 16) A sound sequence (forward sound) is played.
- 17) The motor runs forwards for 5 seconds.
- 18) The motor stops.
- 20 19) Points 3-10 are repeated twice (3 times in all).
- 20) The rule is stopped.

Rule 3:

- 25 1) A pause of 1 second.
- 2) A sound sequence (calibrate sound) is played.
- 3) A sound sequence (start sound) is played.
- 4) A sound sequence (backward sound) is played.
- 5) The motor runs backwards for max. 7 seconds.
- 30 6) If light is detected before the 7 seconds have elapsed (point 5):
 - The motor stops.
 - Forward sound sequence is played.
 - The motor runs forwards as long as light is

detected.

If light disappears:

- i. The motor stops after 0.5 second.
 - ii. If the light comes back within 2
5 seconds, the motor starts again.
 - iii. If the light is out for 2 seconds,
then the motor remains turned off.
- 7) Points 4-6 are repeated as long as light is de-
tected within the 7 seconds and until 3 attempts
10 without light have been made.
- 8) The motor stops.
- 9) The rule stops.

Example of the user's experience: A model is constructed
15 such that when the model drives backwards the model
turns, and when it drives forwards it drives straight
ahead. The rule therefore gives a search light function -
when the user throws light on the model, the model drives
forwards toward the user.

20

Fig. 7 shows a program for selecting a subset of program
steps from a set of program steps in response to an op-
eration selection. The operation selection can e.g. take
place by operating the switch 111. The flow chart starts
25 in step 700. Then a subset of program steps is selected.
A subset of program steps is also called a rule. In 701,
rule R is selected from a collection of predetermined
rules R1-R7 in the form of rule based programs stored in
the memory 110. It is decided in step 702 whether the se-
lected rule is $R=R1$. If this is the case (yes), the rule
30 based program R1 is executed in step 703. Alternatively
(no), it is checked whether rule $R=R2$ was selected. Cor-
respondingly, it is decided in steps 704, 706 and 708
whether the selected rule is rule 2, 3 or 7, and respec-

tive rule based programs are executed in steps 705, 707 or 709. It is thus possible to select one of several predetermined rules. These rules may e.g. be determined by the manufacturer of the toy element.

5

As described above, it is possible to store user-defined rules by combining the predetermined rules.

Fig. 8 shows a toy structure comprising a microprocessor controlled toy building element according to the invention coupled together with generally known toy building elements. The microprocessor controlled toy building element 801 is coupled on top of a structure 805 of building elements and two motors (not shown). The motors drive a wheel at each side of the vehicle, of which only the wheel 802 on one side of the toy structure is visible. The wheels are driven by a shaft 804 which is connected with the motor via gear wheels 803. The motors are electrically connected to the toy building element 801 by means of wires 815.

10
15
20

The toy structure moreover comprises two movable arms 806 which are pivotable about a bearing 807, so that the arms, when being pivoted, can be caused to affect a set of switches 808. The switches 808 are electrically connected to the toy element 801 via wires 809.

25

The toy element may be operated via the keys 813. The display 812 can show information, as described above in connection with fig. 2. The toy element 801 has a set of electrical contact faces 810 and 811, to which the wires 809 and 815 may be connected for receiving signals and emitting signals, respectively.

30

By suitable programming of the toy element 801 the vehicle may be caused to drive round obstacles that may affect the arms 806.

P a t e n t C l a i m s :

1. A microprocessor controlled toy building element
5 (101, 501) comprising

 a microprocessor (102, 507) which can execute instruc-
 tions in the form of a program stored in a memory (117,
 509), said memory comprising subprograms (R1, R2,..., R6)
10 which can be activated individually by specifying a list
 of subprogram calls;

 coupling means for coupling with building elements which
 can be moved by activation means, said activation means
15 being controllable in response to the instructions,

 c h a r a c t e r i z e d b y c o m p r i s i n g

 communications means (504, 505) which can transmit said
20 function calls to a second toy building element (502) for
 programming of it.

2. A microprocessor controlled toy building element ac-
 cording to claim 1, c h a r a c t e r i z e d b y c o m -
25 p r i s i n g a d i s p l a y (1 0 4 , 5 0 8) w h i c h c a n s h o w a p l u r a l i t y
 of icons (204, 205, 206, 207, 208), each of which repre-
 sents instructions to the microprocessor (102, 507), and
 which can be activated by a user for programming of the
 microprocessor.

30

3. A microprocessor controlled toy building element ac-
 cording to claims 1-2, c h a r a c t e r i z e d i n t h a t
 instructions, corresponding to an icon, implement a rule
 (R1, R2,..., R6) by controlling the activation means in

response to signals from sensors connected to the toy building element.

4. A microprocessor controlled toy building element according to claims 1-2, characterized by comprising a receiver (504, 505) for wireless reception of instructions.

5. A microprocessor controlled toy building element according to claims 1-2, characterized by comprising a receiver (505) for reception of infrared signals.

6. A microprocessor controlled toy building element according to claims 1-2, characterized by comprising a keyboard for manual entering of instructions.

7. A microprocessor controlled toy building element according to claims 1-2, characterized by comprising a transmitter (504, 505) for wireless transmission of instructions to the second toy.

8. A microprocessor controlled toy building element according to claims 1-2, characterized by comprising a transmitter (504) for transmission of said function calls via a light guide (503).

9. A microprocessor controlled toy building element according to claims 1-2, characterized by comprising an elongated light guide (503) through which visible light can be transmitted in its longitudinal direction, said light guide (503) being adapted to allow part of the light transmitted to escape through its sides.

10. A toy building set comprising microprocessor controlled toy building elements according to any one of claims 1-9, c h a r a c t e r i z e d by comprising
5 first and second microprocessor controlled toy building elements (501, 502), where the second microprocessor controlled toy building element (502) comprises a memory (516) with subprograms (R1, R2, ..., R6) which can be activated individually by receiving subprogram calls from
10 the first toy building element (501).

11. A toy building set according to claim 10, c h a r -
a c t e r i z e d in that the first microprocessor controlled toy building element comprises operating means
15 (508) for making a program, and that the second microprocessor controlled toy building element comprises operating means for activating just one of several programs.

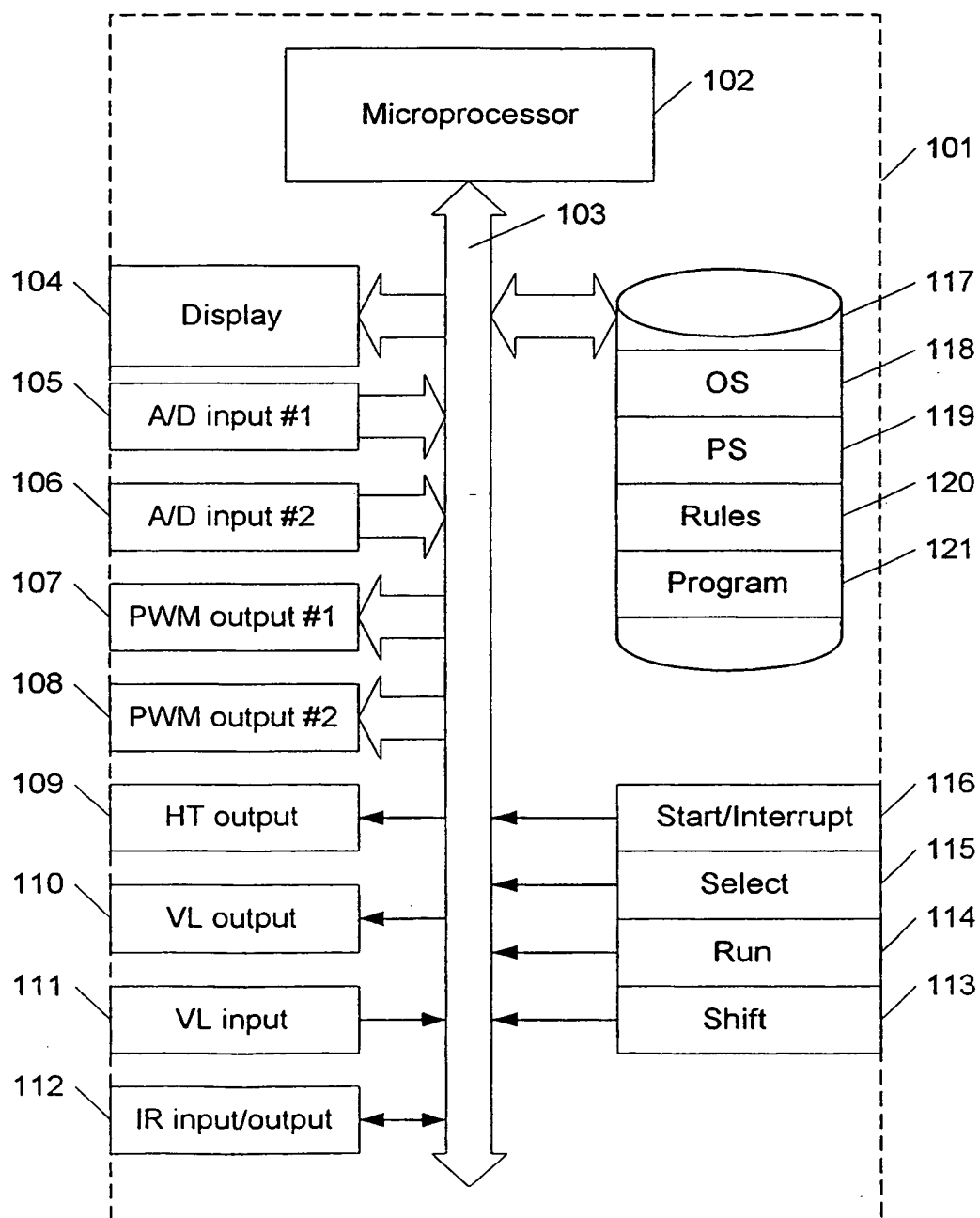


Fig. 1

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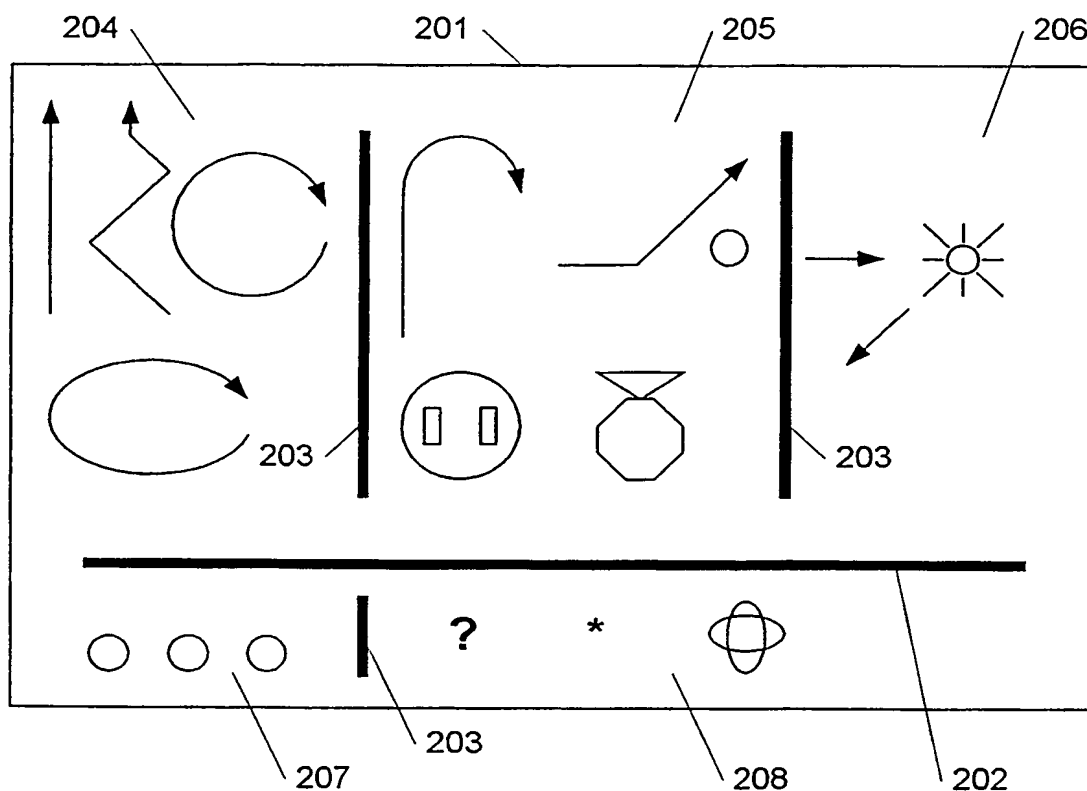


Fig. 2

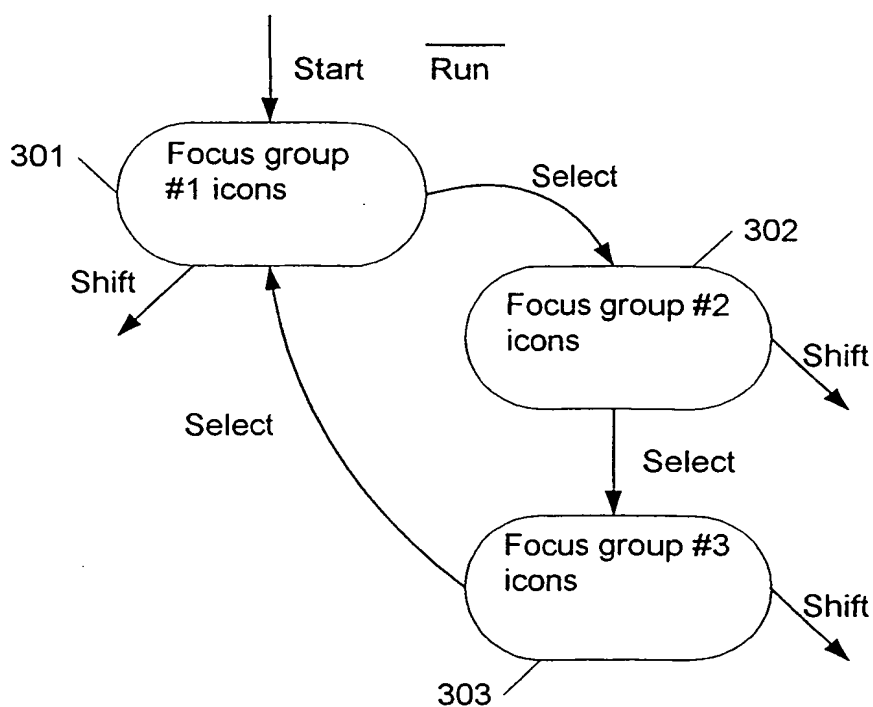


Fig. 3a

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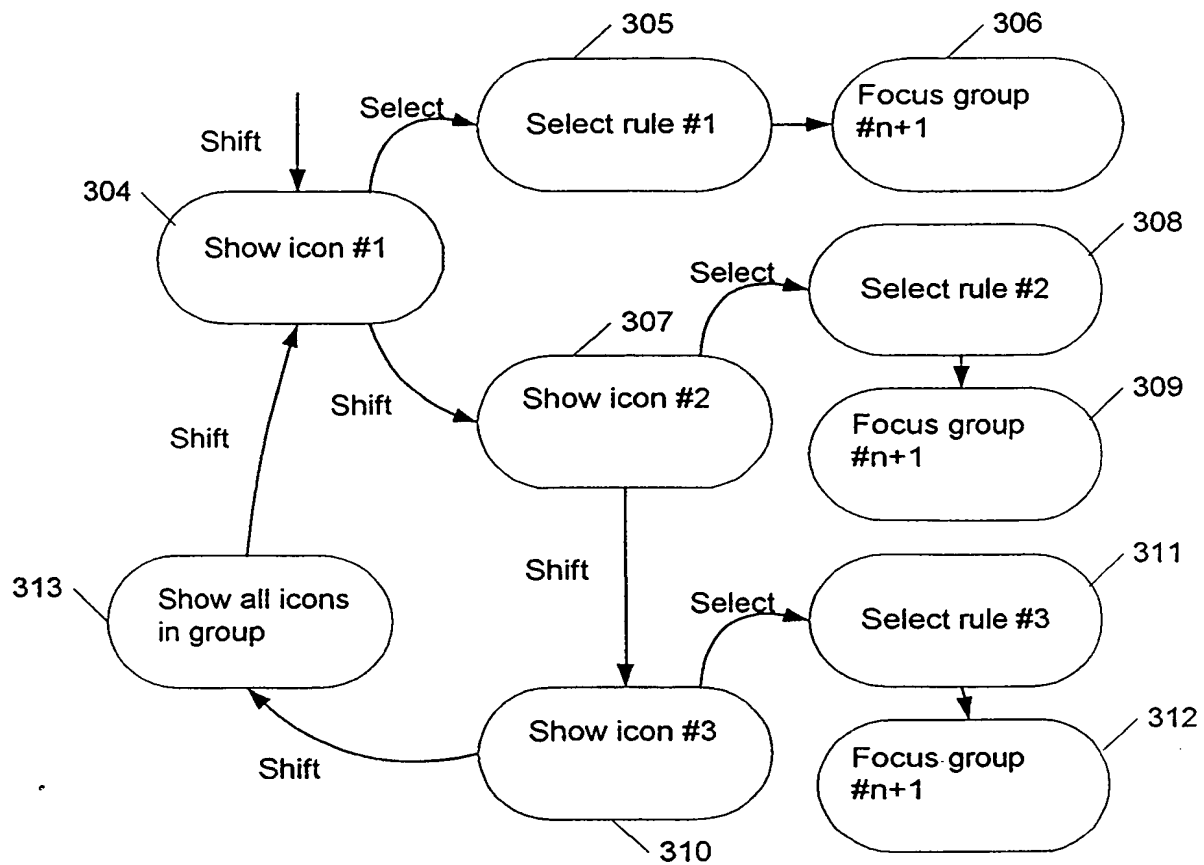


Fig. 3b

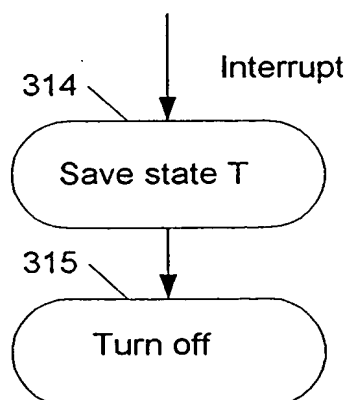


Fig. 3c

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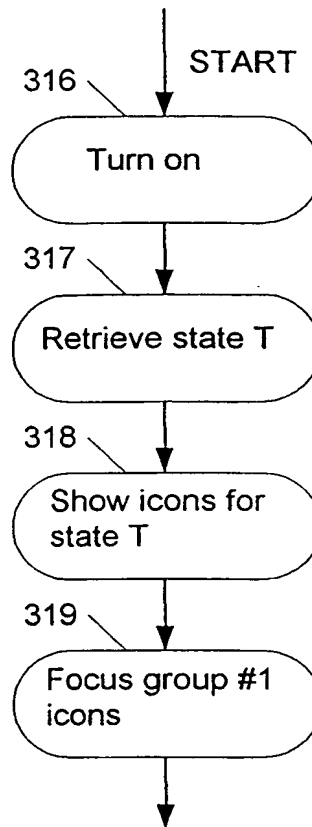


Fig. 3d

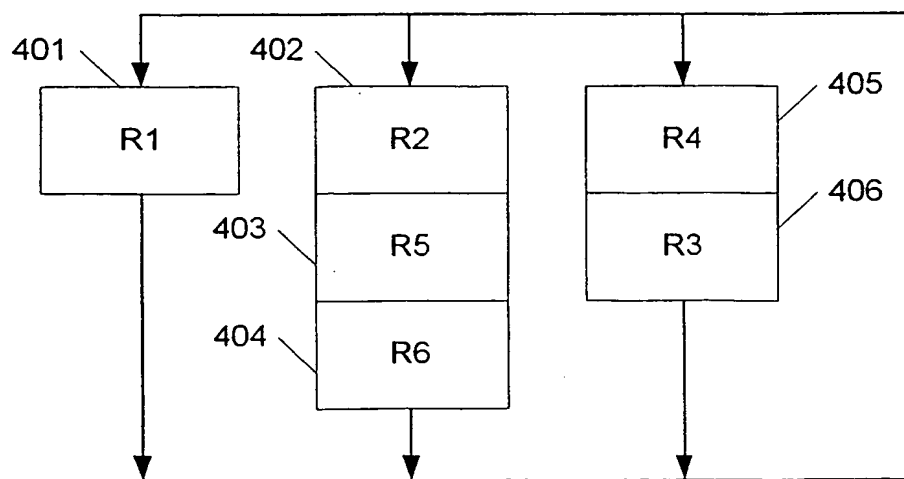


Fig. 4

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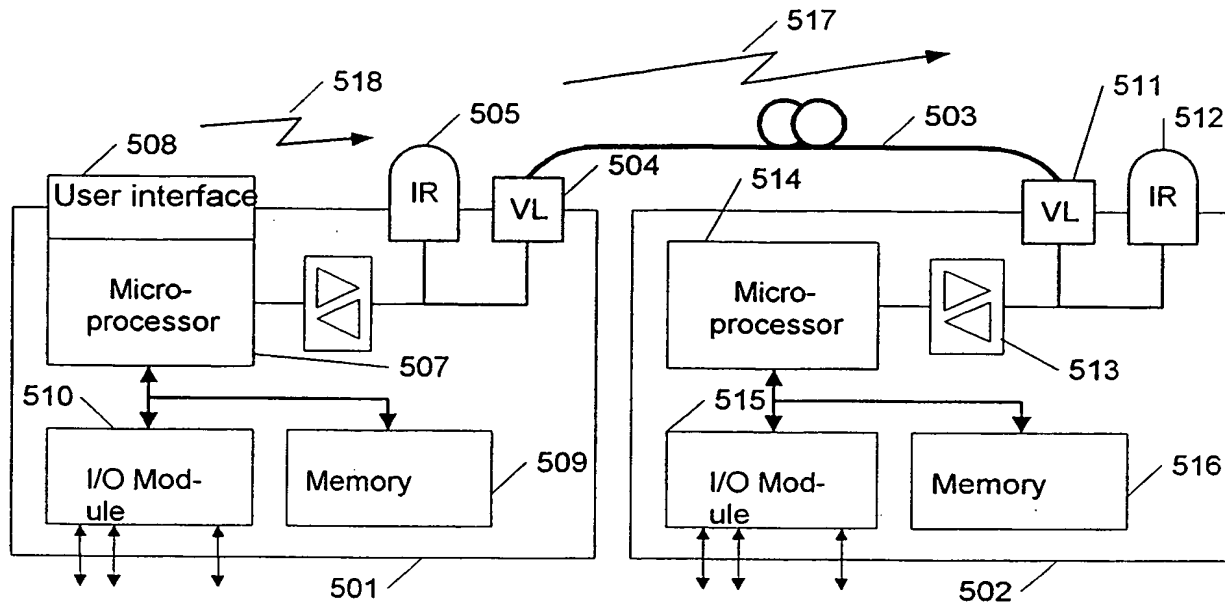


Fig. 5

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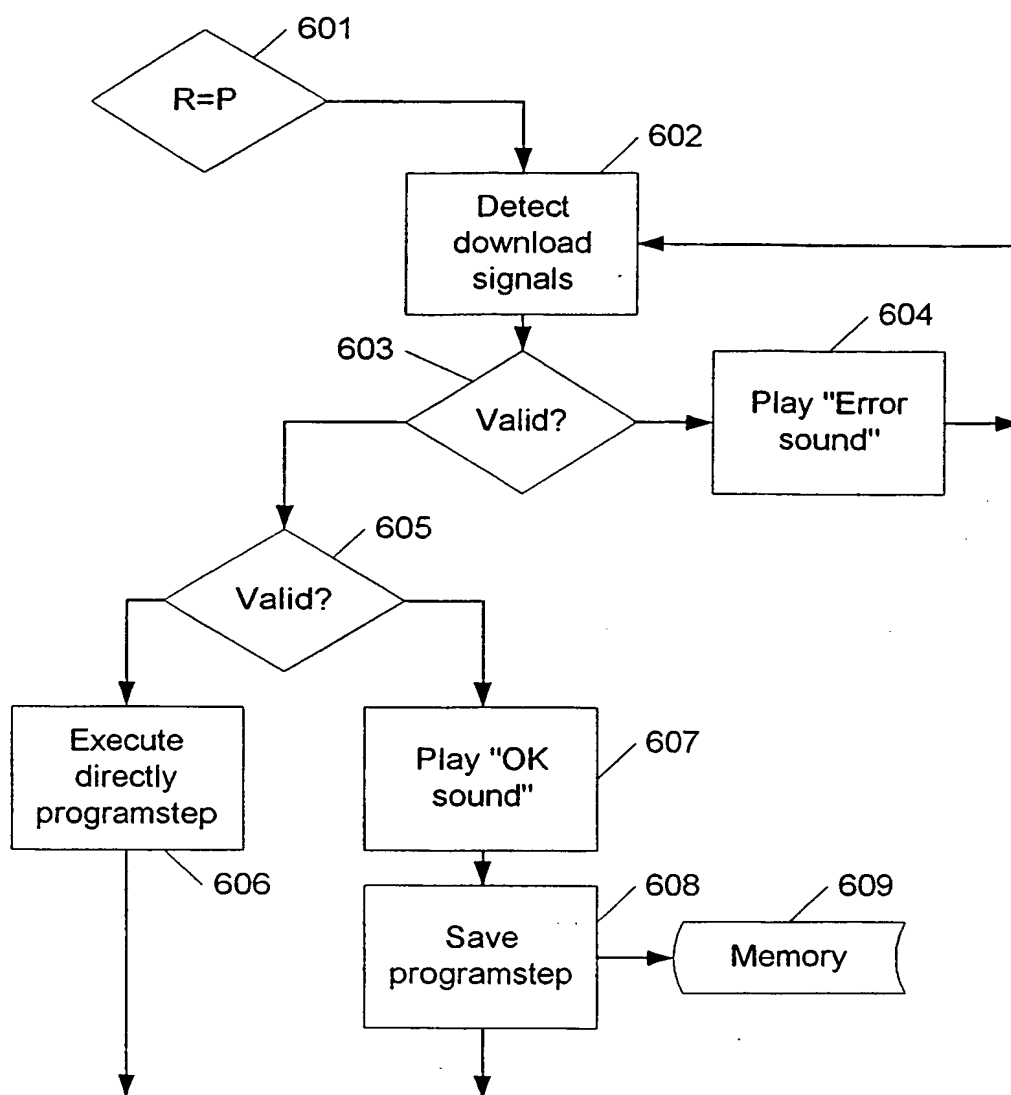


Fig. 6

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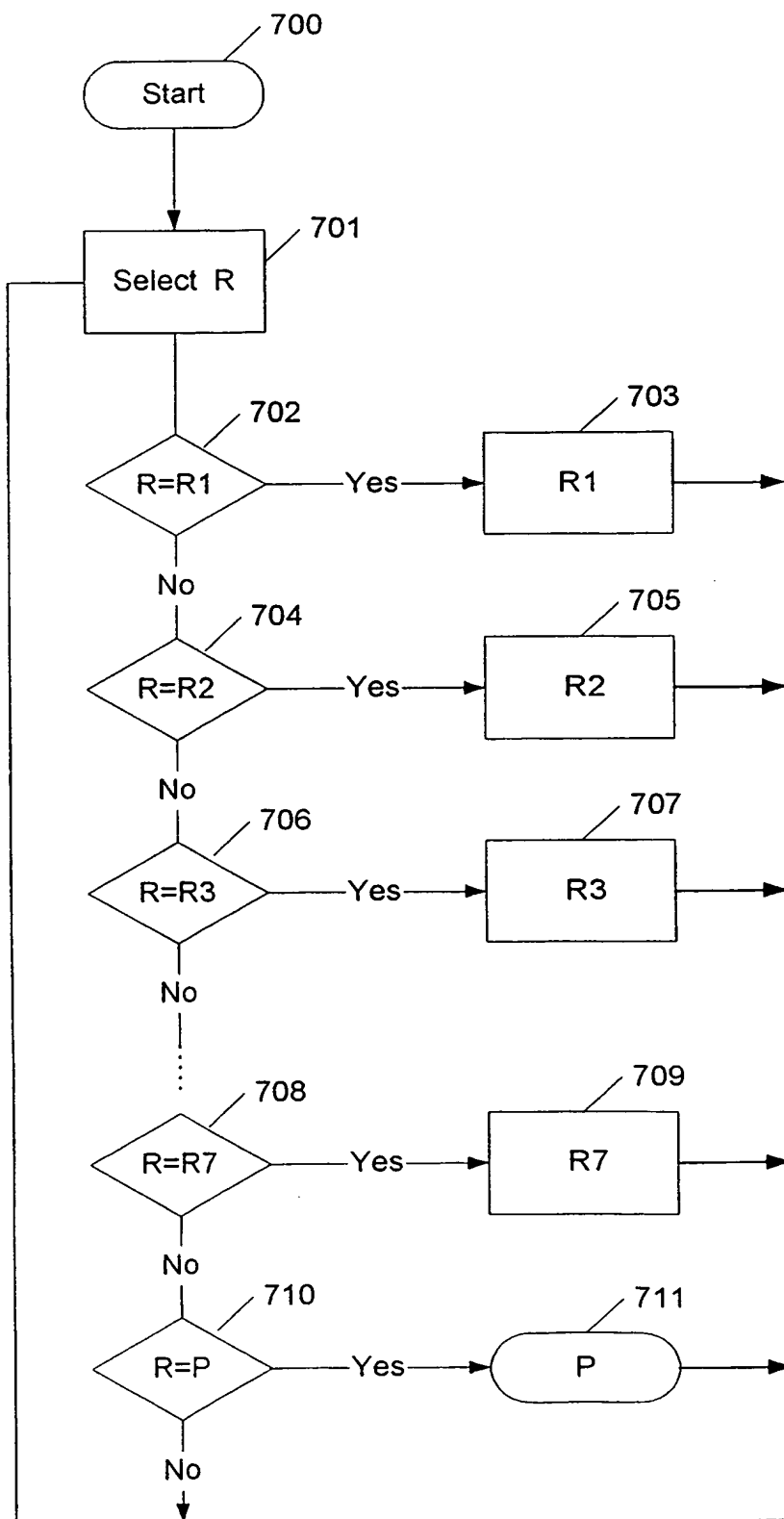


Fig. 7

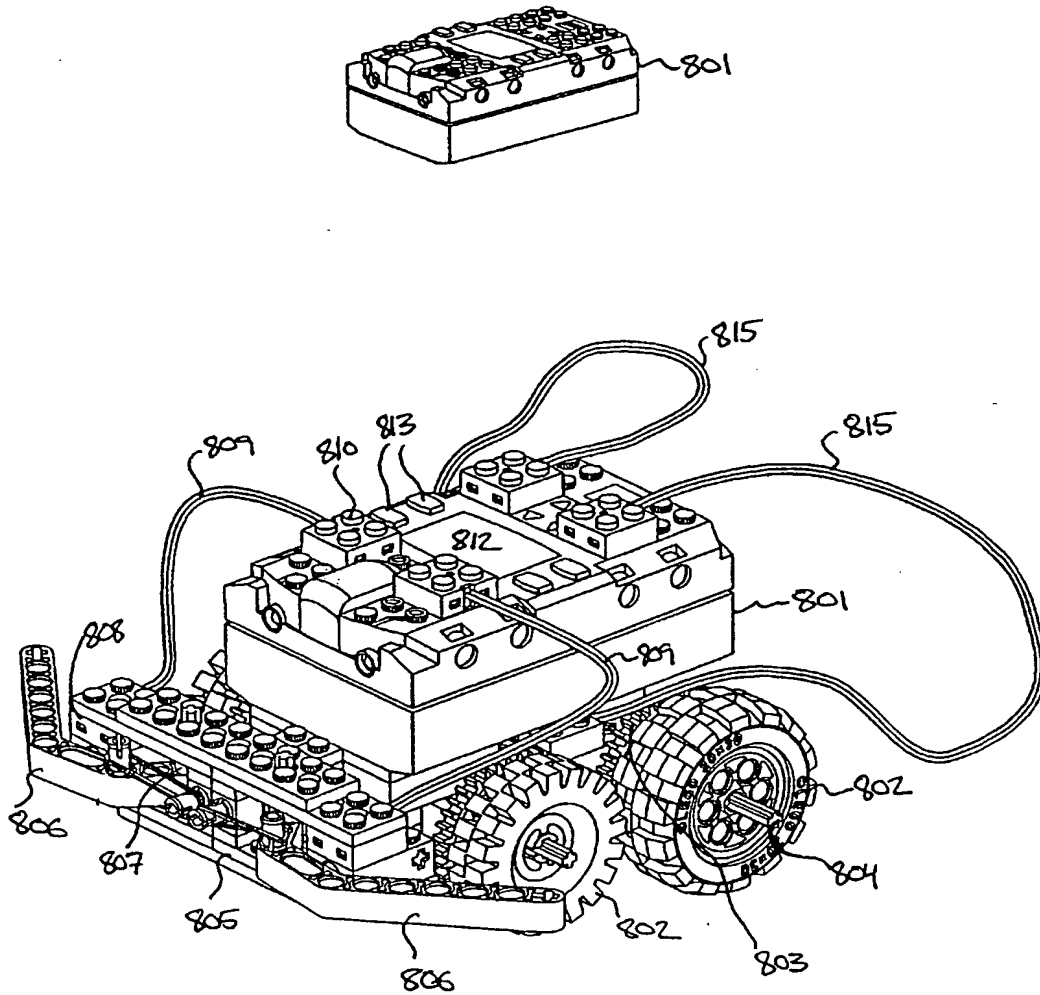


Fig. 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/DK 00/00050

A. CLASSIFICATION OF SUBJECT MATTER		
IPC7: A63H 30/04 // A63H 017/395, A63H 033/00 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
IPC7: A63H, G09B		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
SE,DK,FI,NO classes as above		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5127658 A (OPENIANO), 7 July 1992 (07.07.92), abstract --	1-11
A	US 4938483 A (YAVETZ), 3 July 1990 (03.07.90), abstract -- -----	1-11
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "I" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "I" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search		Date of mailing of the international search report
16 May 2000		19 -05- 2000
Name and mailing address of the ISA Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86		Authorized officer Caroline Stolt/AB Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

Information on patent family members

02/12/99

International application No.

PCT/DK 00/00050

Patent document cited in search report			Publication date	Patent family member(s)	Publication date
US	5127658	A	07/07/92	NONE	
US	4938483	A	03/07/90	NONE	

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

14

Applicant's or agent's file reference P199900136 WO	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/DK00/00050	International filing date (day/month/year) 04/02/2000	Priority date (day/month/year) 04/02/1999
International Patent Classification (IPC) or national classification and IPC A63H30/04		
Applicant LEGO A/S et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 5 sheets, including this cover sheet.

- ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 1 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 21/08/2000	Date of completion of this report 29.05.2001
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Squeri, M Telephone No. +49 89 2399 8417 

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/DK00/00050

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, pages:

1-22 as originally filed

Claims, No.:

3 (part), 4-11 as originally filed

1, 2, 3 (part) with telefax of 04/05/2001

Drawings, sheets:

1/8-8/8 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/DK00/00050

- ☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-11
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-11
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-11
	No:	Claims	

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

Reference is made to the following documents:

D1: WO9002983

D2: US-A-5127658

D3: US-A-4938483

SECTION V:

1. A microprocessor controlled toy building element as described in the preamble of claim 1 is known from D1. The communication means to transmit the list of subprogram calls to a second toy element suitable for programming of it are there not disclosed.

Therefore, claim 1 meets the requirements of Article 33.2 PCT.

Documents D2 and D3 both disclose microprocessor controlled toy elements which have communication means for controlling a second toy element but they are not suitable for programming of it.

Moreover, in the available prior art there is no suggestion that the communication means between a microprocessor controlled toy building and a second toy element could be suitable for programming the second toy element.

Consequently, claim 1 involves also an inventive step (Article 33.3 PCT).

The device disclosed in claim 1 is industrially applicable as a toy building element.

2. Claims 2-9 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.
3. Claim 10 relates to a toy building set comprising microprocessor controlled building elements according to one of the claims 1-9, which (see above) meet the requirements of Article 33 PCT. Consequently, also claim 10 is considered to meet the requirements of Article 33 PCT.
4. Claim 11 is dependent on claim 10 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

SECTION VII:

5. Contrary to the requirements of Rule 5.1.a.ii PCT, the relevant background art disclosed in the document D1 is not mentioned in the description, nor is this document identified therein.
6. According to the requirements of Rule 11.13.I PCT, reference signs not appearing in the description shall not appear in the drawings, and vice versa. This requirement is not met in view of the reference sign 506 at page 15 of the description.

AMENDED CLAIM 1:

1. A microprocessor controlled toy building element
5 (101, 501) comprising

a microprocessor (102, 507) which can execute instruc-
tions in the form of a program stored in a memory (117,
509), said memory comprising subprograms (R1, R2, ..., R6)
10 which can be activated individually by specifying a list
of subprogram calls;

coupling means inter-connectable with building elements
that can be moved by activation means, said activation
15 means being controllable in response to the instructions,

c h a r a c t e r i z e d by comprising

communications means (504, 505) which can transmit the
20 list of subprogram calls to a second toy building element
(502) for programming of it.

2. A microprocessor controlled toy building element ac-
cording to claim 1, c h a r a c t e r i z e d by com-
25 prising a display (104, 508) which can show a plurality
of icons (204, 205, 206, 207, 208), each of which repre-
sents instructions to the microprocessor (102, 507), and
which can be activated by a user for programming of the
microprocessor.

30

3. A microprocessor controlled toy building element ac-
cording to claims 1-2, c h a r a c t e r i z e d in that
instructions, corresponding to an icon, implement a rule
(R1, R2, ..., R6) by controlling the activation means in

AMENDED SHEET

PATENT COOPERATION TREATY

VCH

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION CONCERNING
SUBMISSION OR TRANSMITTAL
OF PRIORITY DOCUMENT

(PCT Administrative Instructions, Section 411)

To:

HOFMAN-BANG A/S
Hans Bekkevolds Allé 7
DK-2900 Hellerup
DANEMARK

RECEIVED

17 APR. 2000

Hofman-Bang & Boutard,
Lehmann & Ree A/S

Date of mailing (day/month/year) 06 April 2000 (06.04.00)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference P199900136 WO <i>BLO</i>	
International application No. PCT/DK00/00050	International filing date (day/month/year) 04 February 2000 (04.02.00)
International publication date (day/month/year) Not yet published	Priority date (day/month/year) 04 February 1999 (04.02.99)
Applicant LEGO A/S et al <i>FORODL 2/6-2000</i>	

1. The applicant is hereby notified of the date of receipt (except where the letters "NR" appear in the right-hand column) by the International Bureau of the priority document(s) relating to the earlier application(s) indicated below. Unless otherwise indicated by an asterisk appearing next to a date of receipt, or by the letters "NR" in the right-hand column, the priority document concerned was submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b).
2. This updates and replaces any previously issued notification concerning submission or transmittal of priority documents.
3. An asterisk(*) appearing next to a date of receipt, in the right-hand column, denotes a priority document submitted or transmitted to the International Bureau but not in compliance with Rule 17.1(a) or (b). In such a case, the attention of the applicant is directed to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.
4. The letters "NR" appearing in the right-hand column denote a priority document which was not received by the International Bureau or which the applicant did not request the receiving Office to prepare and transmit to the International Bureau, as provided by Rule 17.1(a) or (b), respectively. In such a case, the attention of the applicant is directed to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

<u>Priority date</u>	<u>Priority application No.</u>	<u>Country or regional Office or PCT receiving Office</u>	<u>Date of receipt of priority document</u>
04 Febr 1999 (04.02.99)	PA 1999 00144	DK	14 Marc 2000 (14.03.00)

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No. (41-22) 740.14.35

Authorized officer

Marie-José Devillard

Telephone No. (41-22) 338.83.38

Form PCT/IB/304 (July 1998)

003213730

RECEIVED

18 OCT 2000

Hofman-Bang & Bostard,
Lehmann & Rees & Co.

PATENT COOPERATION TREATY

PCT/DK00/00050

VdL

PCT

From the INTERNATIONAL BUREAU

To:

HOFMAN-BANG A/S
Hans Bekkevolds Allé 7
DK-2900 Hellerup
DANEMARKINFORMATION CONCERNING ELECTED
OFFICES NOTIFIED OF THEIR ELECTION

(PCT Rule 61.3)

Date of mailing (day/month/year) 09 October 2000 (09.10.00)		
Applicant's or agent's file reference P199900136 WO <i>B6U</i>		IMPORTANT INFORMATION
International application No. PCT/DK00/00050	International filing date (day/month/year) 04 February 2000 (04.02.00)	Priority date (day/month/year) 04 February 1999 (04.02.99)
Applicant LEGO A/S et al <i>Indodg 1/6-2001</i>		

1. The applicant is hereby informed that the International Bureau has, according to Article 31(7), notified each of the following Offices of its election:

AP : GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW

EP : AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE

National : AU, BG, CA, CN, CZ, DE, IL, JP, KP, KR, MN, NO, NZ, PL, RO, RU, SE, SK, US

2. The following Offices have waived the requirement for the notification of their election; the notification will be sent to them by the International Bureau only upon their request:

EA : AM, AZ, BY, KG, KZ, MD, RU, TJ, TM

OA : BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG

National : AE, AL, AM, AT, AZ, BA, BB, BR, BY, CH, CR, CU, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IN, IS, KE, KG, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MW, MX, PT, SD, SG, SI, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW

3. The applicant is reminded that he must enter the "national phase" before the expiration of 30 months from the priority date before each of the Offices listed above. This must be done by paying the national fee(s) and furnishing, if prescribed, a translation of the international application (Article 39(1)(a)), as well as, where applicable, by furnishing a translation of any annexes of the international preliminary examination report (Article 36(3)(b) and Rule 74.1).

Some offices have fixed time limits expiring later than the above-mentioned time limit. For detailed information about the applicable time limits and the acts to be performed upon entry into the national phase before a particular Office, see Volume II of the PCT Applicant's Guide.

The entry into the European regional phase is postponed until 31 months from the priority date for all States designated for the purposes of obtaining a European patent.

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer: Manu Berrod <i>MB</i>
Facsimile No. (41-22) 740.14.35	Telephone No. (41-22) 338.83.38

Blufudl

From the INTERNATIONAL BUREAU

PCT

NOTICE INFORMING THE APPLICANT OF THE
COMMUNICATION OF THE INTERNATIONAL
APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

To:

HOFMAN-BANG A/S
Hans Bekkevolds Allé 7
DK-2900 Hellerup
DANEMARK

RECEIVED

18 AUG. 2000

Hofman-Bang & Boutard,
Lehmann & Ree A/s

Date of mailing (day/month/year) 10 August 2000 (10.08.00)		IMPORTANT NOTICE	
Applicant's or agent's file reference P199900136 WO			
International application No. PCT/DK00/00050	International filing date (day/month/year) 04 February 2000 (04.02.00)	Priority date (day/month/year) 04 February 1999 (04.02.99)	
Applicant LEGO A/S et al			

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:

AU,JP,KP,KR,US

In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:

AE,AL,AM,AP,AT,AZ,BA,BB,BG,BR,BY,CA,CH,CN,CR,CU,CZ,DE,DK,DM,EA,EE,EP,ES,FI,GB,GD,
GE,GH,GM,HR,HU,ID,IL,IN,IS,KE,KG,KZ,LC,LK,LR,LS,LT,LU,LV,MA,MD,MG,MK,MN,MW,MX,NO,
NZ,OA,PL,PT,RO,RU,SD,SE,SG,SI,SK,SL,TJ,TM,TR,TT,TZ,UA,UG,UZ,VN,YU,ZA,ZW

The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on 10 August 2000 (10.08.00) under No. WO 00/45925

REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, a demand for international preliminary examination must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the national phase, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. (41-22) 740.14.35	Authorized officer J. Zahra Telephone No. (41-22) 338.83.38
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PATENT COOPERATION TREATY

BLO/UDL

PCT

From the INTERNATIONAL BUREAU

NOTIFICATION OF THE RECORDING
OF A CHANGE(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

To:

HOFMAN-BANG A/S
Hans Bekkevolds Allé 7
DK-2900 Hellerup
DANEMARK

RECEIVED

15 SEP. 2000

Hofman-Bang & Boutard,
Lehmann & Ree A/S

Date of mailing (day/month/year) 08 September 2000 (08.09.00)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference P199900136 WO	
International application No. PCT/DK00/00050	International filing date (day/month/year) 04 February 2000 (04.02.00)

1. The following indications appeared on record concerning:		
<input checked="" type="checkbox"/> the applicant	<input checked="" type="checkbox"/> the inventor	<input type="checkbox"/> the agent <input type="checkbox"/> the common representative
Name and Address RASMUSSEN, Jesper Thit Jensen Vej 37 DK-7182 Bredsted Denmark	State of Nationality DK	State of Residence DK
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	
2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:		
<input type="checkbox"/> the person	<input type="checkbox"/> the name	<input checked="" type="checkbox"/> the address <input type="checkbox"/> the nationality <input type="checkbox"/> the residence
Name and Address RASMUSSEN, Jesper Thit Jensen Vej 37 DK-7182 Bredsten Denmark	State of Nationality DK	State of Residence DK
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	
3. Further observations, if necessary:		
4. A copy of this notification has been sent to:		
<input checked="" type="checkbox"/> the receiving Office	<input checked="" type="checkbox"/> the designated Offices concerned	
<input type="checkbox"/> the International Searching Authority	<input type="checkbox"/> the elected Offices concerned	
<input type="checkbox"/> the International Preliminary Examining Authority	<input type="checkbox"/> other:	

The International Bureau of WIPO 34, chemin des Colombettes 1211 G n va 20, Switz rland Facsimile No.: (41-22) 740.14.35	Authorized officer C. Cupello <i>Cupello</i> Telephone No.: (41-22) 338.83.38
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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P199900136 WO	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/DK00/00050	International filing date (day/month/year) 04/02/2000	Priority date (day/month/year) 04/02/1999
International Patent Classification (IPC) or national classification and IPC A63H30/04		
Applicant LEGO A/S et al.		


1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

 These annexes consist of a total of 1 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 21/08/2000	Date of completion of this report 29.05.2001
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Squeri, M Telephone No. +49 89 2399 8417



INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/DK00/00050

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, pages:

1-22 as originally filed

Claims, No.:

3 (part), 4-11 as originally filed

1, 2, 3 (part) with telefax of 04/05/2001

Drawings, sheets:

1/8-8/8 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/DK00/00050

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-11
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-11
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-11
	No:	Claims	

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

Reference is made to the following documents:

D1: WO9002983

D2: US-A-5127658

D3: US-A-4938483

SECTION V:

1. A microprocessor controlled toy building element as described in the preamble of claim 1 is known from D1. The communication means to transmit the list of subprogram calls to a second toy element suitable for programming of it are there not disclosed.

Therefore, claim 1 meets the requirements of Article 33.2 PCT.

Documents D2 and D3 both disclose microprocessor controlled toy elements which have communication means for controlling a second toy element but they are not suitable for programming of it.

Moreover, in the available prior art there is no suggestion that the communication means between a microprocessor controlled toy building and a second toy element could be suitable for programming the second toy element.

Consequently, claim 1 involves also an inventive step (Article 33.3 PCT).

The device disclosed in claim 1 is industrially applicable as a toy building element.

2. Claims 2-9 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.
3. Claim 10 relates to a toy building set comprising microprocessor controlled building elements according to one of the claims 1-9, which (see above) meet the requirements of Article 33 PCT. Consequently, also claim 10 is considered to meet the requirements of Article 33 PCT.
4. Claim 11 is dependent on claim 10 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

SECTION VII:

5. Contrary to the requirements of Rule 5.1.a.ii PCT, the relevant background art disclosed in the document D1 is not mentioned in the description, nor is this document identified therein.
6. According to the requirements of Rule 11.13.I PCT, reference signs not appearing in the description shall not appear in the drawings, and vice versa. This requirement is not met in view of the reference sign 506 at page 15 of the description.

PCT COOPERATION TREATY

PCT

NOTIFICATION OF THE RECORDING
OF A CHANGE(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

HOFMAN-BANG A/S
Hans Bekkevolds Allé 7
DK-2900 Hellerup
DANEMARK

Date of mailing (day/month/year)

08 September 2000 (08.09.00)

Applicant's or agent's file reference

P199900136 WO

IMPORTANT NOTIFICATION

International application No.

PCT/DK00/00050

International filing date (day/month/year)

04 February 2000 (04.02.00)

1. The following indications appeared on record concerning:

☒

the applicant

☒

the inventor

☐

the agent

☐

the common representative

Name and Address

RASMUSSEN, Jesper
Thit Jensen Vej 37
DK-7182 Bredsted
Denmark

State of Nationality

DK

State of Residence

DK

Telephone No.

Facsimile No.

Teleprinter No.

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☐

the person

☐

the name

☒

the address

☐

the nationality

☐

the residence

Name and Address

RASMUSSEN, Jesper
Thit Jensen Vej 37
DK-7182 Bredsten
Denmark

State of Nationality

DK

State of Residence

DK

Telephone No.

Facsimile No.

Teleprinter No.

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

☒

the receiving Office

☐

the International Searching Authority

☐

the International Preliminary Examining Authority

☒

the designated Offices concerned

☐

the elected Offices concerned

☐

other:

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

C. Cupello

Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents
 United States Patent and Trademark
 Office
 Box PCT
 Washington, D.C. 20231
 ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 09 October 2000 (09.10.00)	
International application No. PCT/DK00/00050	Applicant's or agent's file reference P199900136 WO
International filing date (day/month/year) 04 February 2000 (04.02.00)	Priority date (day/month/year) 04 February 1999 (04.02.99)
Applicant MUNCH, Gaute et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

21 August 2000 (21.08.00)

☐ in a notice effecting later election filed with the International Bureau on:2. The election ☒ was☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO
 34, chemin des Colombettes
 1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

Manu Berrod

Telephone No.: (41-22) 338.83.38